



# **Inventory of Mammals at Ten National Park Service Units in the Northern Great Plains from 2002-2004**

## **Final Report**

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**December 31, 2004****EXECUTIVE SUMMARY**

In 2001, the National Park Service, Northern Great Plains (NGP) Network determined that mammal inventories were needed at Agate Fossil Beds, Devils Tower, Jewel Cave, and Scotts Bluff National Monuments (NM), Mount Rushmore National Memorial (NMEM), Fort Laramie, Fort Union Trading Post, and Knife River Indian Villages National Historic Sites (NHS), the Missouri National Recreational River, and Wind Cave National Park (NP). The NGP Network based this determination on literature reviews, documented species at the park units, scoping workshops, expert opinion, and a comparison of documented species lists to expected species lists. Justification for the project is detailed in the Northern Great Plains Inventory Study Plan (Study Plan).

In 2002, a Cooperative Agreement (02-JV-11221609-212) was established between the National Park Service (NPS) and the US Forest Service Rocky Mountain Research Station (RMRS). This agreement arranged for the use of RMRS equipment and personnel to conduct the required mammal surveys during the period from 2002 through 2004. Drs. Dan Uresk and Mark Rumble (RMRS Rapid City Unit) served as RMRS Technical Representatives for the Cooperative Agreement. The RMRS, in turn, established a cooperative agreement with two universities, Colorado State University and Tarleton State University, to provide mammal experts to conduct the studies. Dr. Dennis Child, Department of Forest, Rangeland and Watershed Stewardship at Colorado State University served as the University Technical Representative. Dr. Cheryl Schmidt, a Research Associate in the same department, served as the Principle Investigator for this project. Dr. Philip Sudman, Associate Professor in the Department of Biological Sciences at Tarleton State University, conducted the surveys on the Missouri National Recreational River.

Surveys were initiated in the summer of 2002 and the field components completed in the summer of 2004. The wildlife camera surveys, conducted by Dan Licht (NGP Inventory and Monitoring Coordinator), occurred during various seasons throughout the year. All other terrestrial mammal trapping and bat surveys occurred between May and September of the three field seasons (2002, 2003, 2004).

Three specific data gaps are addressed by the survey results presented in this report. The first two gaps are represented by park units, Mount Rushmore NMEM and Missouri National Recreational River, which did not have the benefit of information from previous surveys. The lists developed as a result of the 2002-2004 surveys substantially improve the documentation of mammals for these two units. The third data gap addressed herein is a taxonomic group which was underrepresented in previous surveys -- bats. The bat species lists presented in this report substantially increase the numbers of bats documented for those parks in which bat surveys were conducted.

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## AGATE FOSSIL BEDS NATIONAL MONUMENT

### Abstract

Agate Fossil Beds National Monument (AGFO) was surveyed for small, terrestrial mammals in September 2002, and for bats during the summers of 2003 and 2004. Motion-sensing wildlife cameras were deployed for approximately four months during summer and fall of 2003. The combined surveys documented 42% (13 out of 31) of the species previously known to occur at AGFO. The only terrestrial mammal captured in this survey and not previously documented at the Monument was the white-footed mouse (*Peromyscus leucopus*). While no bat species had been previously documented at AGFO, this survey identified one species based on both capture and echolocation (Western small-footed bat, *Myotis ciliolabrum*), and six additional species (Big brown bat – *Eptesicus fuscus*; Silver-haired bat – *Lasionycteris noctivagans*; Eastern red bat – *Lasiurus borealis*; Western long-eared myotis – *Myotis evotis*; Little brown myotis – *M. lucifugus*; and Northern long-eared bat – *M. septentrionalis*) based on analysis of echolocation sequences. Therefore, the results of the combined surveys add a total of eight species to the documented list for Agate Fossil Beds National Monument.

### Methods-Terrestrial Species

#### Habitats/Locations Surveyed

Six Sheman live trap transects were set at this site, three in riparian (RIP) habitat and 3 in grassland (GRA) habitat [UTM Coordinates follow each in brackets]:

- RIP-1 (80 traps) eastern strand of cottonwood/willow on West end of Rd 306 [13T 0601234 4696754]
- RIP-2 (80 traps) western strand of cottonwood/willow on West end of Rd 306 [13T 0601109 4696845]
- RIP-3 (120 traps) along river just south of housing (east end of park) [13T 0604538 4698029]
- GRA-1 (80 traps) starts at rock outcrop straight up (south, across Rd 306) from RIP-2 and proceeds southeast and then east, paralleling the fenceline toward the end of transect [13T 0601049 4696508]
- GRA-2 (80 traps) along strip of sagebrush running between river and Rd 306, just east of Rd 308 [13T 0601810 4696803]
- GRA-3 (120 traps) east-west transect close to northern edge of old potato field between Rds 312 and 313, north of the highway running through the park [13T 0601575 4697799]

## **Survey Methods Used**

**Live Traps.** Sherman live traps were set in linear transects through both riparian and grassland habitats. Each transect consisted of a minimum of 40 stations (2 traps per station), spaced approximately 10m apart. Traps were baited with a grain mixture, covered with vegetation to avoid overheating by direct insolation, and checked early each morning. Captured animals were identified to species and released at the point of capture. The park requested that no vouchers, beyond incidental deaths, be collected. These transects were run for 2 nights, producing 1120 total live trap nights for the site.

**Observation.** In addition to running the live trap transects, the field crew recorded visual observations of mammals or mammal sign.

**Wildlife Cameras.** Eight motion-sensing wildlife cameras were run at five camera stations. Cameras were generally set for a one-minute delay between images. Stations were baited with a variety of lures including herring, fish oil, peanut butter, and fox lure (Appendix B). While the cameras were collectively deployed for 520 camera nights, known malfunctions reduced effective camera nights to 358.

## **Dates**

Sherman live trap transects were run the nights of 16 and 17 September 2002. Visual observations were conducted during daylight hours of 16-18 September 2002. Wildlife cameras were deployed from June 11 to October 18 of 2003.

## **Observers**

Observers for the 16-18 September 2002 field session were Dr. Cheryl Schmidt and Mr. Shaun Dunn. Mr. Dan Licht, NGP I&M Coordinator, ran the wildlife camera survey.

## ***Methods-Bats - 2003***

### **Habitats/Locations Surveyed**

Mist nets were set over the main stem of the Niobrara at points south of the housing area and at the bridge along the hiking trail south of the Visitor Center. A long mist net was also set across the side pond that is north of the main stem, just south of the housing area. Bat detectors were used to determine whether or not bats were active in the area with trees at the western end of the Monument. No bat activity was detected in that area, so no nets were set there.

Walking acoustic surveys were conducted along the main stem of the Niobrara from south of the housing area to the hiking trail bridge south of the Visitor Center, and then up and around the fossil deposit sites, and back. A walking acoustic survey was also conducted among the trees in the western end of the park and in the immediate vicinity of

the Visitor Center. In addition, a bat detector was left running the entirety of two nights at the housing area.

### **Survey Methods Used**

**Mist Nets.** Mist nets were set and opened at dusk and closed at the end of the netting session which was either early morning (1200-0200h) or when weather conditions no longer permitted mist netting.

**Acoustic Surveys.** Acoustic surveys were conducted using Anabat detectors with ZCAIM signal modifiers and Compactflash-card data storage. Acoustic surveys were conducted by a combination of walking along the drainage and adjacent trails, and by leaving the detectors to record remotely at the housing area in the east end of the Monument.

### **Dates**

Mist net and acoustic surveys were conducted the nights of 13-15 June 2003.

### **Observers**

Observers for the bat survey of 13-15 June 2003 were Dr. Cheryl Schmidt and Ms. Shauna Marquardt.

## ***Methods-Bats - 2004***

### **Habitats/Locations Surveyed**

Mist nets were set over the main stem of the Niobrara at the bridge along the hiking trail south of the Visitor Center. No nets were set south of the housing area because the side pond was completely dry and the adjacent site produced no bats the previous year (2003).

Acoustic monitoring was conducted at and proximal to the bridge south of the Visitor Center. Bats were observed and recorded flying in this area.

### **Survey Methods Used**

**Mist Nets.** Mist nets were set and opened at dusk and closed at the end of the netting session which was either early morning (1200-0200h) or when weather conditions no longer permitted mist netting.

**Acoustic Monitoring.** Acoustic monitoring was conducted using Anabat detectors with ZCAIM signal modifiers and Compactflash-card data storage. Acoustic monitoring was conducted by placing the detector close to the trail south of and higher than the bridge, and by leaving the detector on the bridge to record bats as they flew along the drainage.

### **Dates**

Bat surveys were conducted at Agate Fossil Beds National Monument the nights of 5-7 August 2004. Weather was again problematic, with nightly storms and winds continuing after the storms had passed.

### **Observers**

Surveyors were Dr. Cheryl Schmidt and Ms. Shauna Marquardt.

## ***Results-Terrestrial Species***

### **Individuals Detected**

Eight species of terrestrial mammals were captured in the Sherman live traps during this survey (Table 1). The white-footed mouse (*Peromyscus leucopus*) was the only species not previously documented in the Monument.

In addition to the mammals captured in the Sherman live traps, the 2002 field season produced the following visual observations:

- Shed antlers of mule deer (*Odocoileus hemionus*) and white tailed deer (*O. virginianus*) were observed at RIP-2 and GRA-3 respectively.
- Pocket gopher mounds were abundant and probably represent *Geomys bursarius*, the plains pocket gopher.
- A coyote (*Canis latrans*) was observed north of the river, across from Rd 308.
- Rabbits (cottontails; *Sylvilagus* spp.) were observed at a distance around the visitor's center.

The 2003 field season produced nocturnal observations of a porcupine (*Erethizon dorsatum*) along the river in the eastern portion of the Monument.

Table 1. Mammals caught in Sherman live-trap transects during September 2002 field session.

TAXA		Grassland			Riparian			TOTALS:
Scientific Name	Common Name	GRA-1	GRA-2	GRA-3	RIP-1	RIP-2	RIP-3	
<i>Chaetodipus hispidus</i>	Hispid pocket mouse	2	1		4	3	2	12
<i>Dipodomys ordii</i>	Ord's kangaroo rat	1		12				13
<i>Microtus ochrogaster</i>	Prairie vole					3	3	6
<i>Onychomys leucogaster</i>	Northern grasshopper mouse	1						1
<i>Perognathus flavus</i>	Silky pocket mouse			1				1
<i>Peromyscus leucopus</i>	White-footed mouse				1			1
<i>Peromyscus maniculatus</i>	Deer mouse	25	10	6	31	13	2	87
<i>Reithrodontomys megalotis</i>	Western harvest mouse					1	3	4
<i>Spermophilus tridecemlineatus</i>	Thirteen-lined ground squirrel	1						1

**Wildlife Cameras.** The 358 camera nights at AGFO produced 51 identifiable images as follows:

White-tailed deer (*Odocoileus virginianus*) – 36  
 Unknown deer (*Odocoileus* sp.) – 12  
 Raccoons (*Procyon lotor*) -- 3

**Alphabetical List of Terrestrial Mammals Captured/Observed/Photographed**

*Canis latrans* -- Coyote  
*Chaetodipus hispidus* – Hispid Pocekt Mouse  
*Dipodomys ordii* – Ord's Kangaroo Rat  
*Erethizon dorsatum* – Porcupine  
*Geomys bursarius* – Plains pocket gopher  
*Microtus ochrogaster* – Prairie Vole  
*Odocoileus hemionus* – Mule deer  
*Odocoileus virginianus* – White-tailed deer  
*Onychomys leucogaster* – Grasshopper Mouse  
*Perognathus flavus* – Silky Pocket Mouse  
*Peromyscus leucopus* – White-footed Mouse



*Peromyscus maniculatus* – Deer Mouse*Procyon lotor* – Raccoon*Reithrodontomys megalotis* – Western Harvest Mouse*Spermophilus tridecemlineatus* – Thirteen-lined Ground Squirrel*Sylvilagus* spp. – Cottontail rabbits

## **Results-Bats (2003 and 2004)**

### **Individuals Detected**

**Mist Nets.** The nets set in 2003 along the main stem of the river and the side pond produced one swallow and one nighthawk, respectively. The nets set proximal to the bridge in 2004 produced one Western small-footed bat (*Myotis ciliolabrum*).

A volunteer at the park indicated that she had observed a mummified bat at one of the excavation sites earlier in the summer of 2004. While she thought the bat was a pipistrelle, based on her description we believe the bat was actually a Western small-footed bat.

**Acoustic Surveys.** The survey in the western portion of the park produced no calls. The walking survey at the eastern end of the park did yield a few passes, as did the detector left to monitor remotely at the housing unit. Acoustic recordings were screened and clean, single-species calls were selected for identification. A discriminant function model was developed based on known-species calls and then used to assign the selected calls to species. Using this process, seven bat species were identified at AGFO based on their echolocation calls (Table 2).

Table 2. Bat species identified at AGFO, based on statistical analysis of echolocation calls.

<b>Species Name</b>	<b>Common Name</b>	<b>2003</b>	<b>2004</b>
<i>Eptesicus fuscus</i>	Big brown bat		X
<i>Lasionycteris noctivagans</i>	Silver-haired bat	X	X
<i>Lasiurus borealis</i>	Eastern red bat		X
<i>Myotis ciliolabrum</i>	Western small-footed myotis		X
<i>M. evotis</i>	Western long-eared myotis		X
<i>M. lucifugus</i>	Little brown bat	X	X
<i>M. septentrionalis</i>	Northern long-eared myotis	X	X

### ***Species Not Documented but Possibly Present***

Pocket gopher mounds were observed in many areas of the Monument. While these animals were not trapped due to lack of necessary traps, they most likely were produced by the Plains pocket gopher (*Geomys bursarius*) which has been previously documented for the Monument.

Another species that may be present is the meadow jumping mouse (*Zapus hudsonius*). It is possible that this species could have extended its range as far west as the Monument, using the Niobrara drainage corridor for dispersal.

Finally, although not observed during these surveys, the ubiquitous badger (*Taxidea taxus*) may well occur on or in the vicinity of AGFO.

### ***Species on Park Expected List but Probably Not Present***

Appendix A provides a summary of species that are expected at AGFO, were documented at AGFO prior to the surveys reported here-in, or are identified in this report as occurring at AGFO. While spotted ground squirrels (*Spermophilus spilosoma*) and the least chipmunk (*Tamias minimus*) have not been documented at AGFO, monitoring for these species should continue as ranges for many species continue to shift across the region.

## ***Recommendations to Park Management***

### **Long-term Monitoring Recommendations**

As indicated above, the geographic ranges of many species are dynamic across the region. Therefore, long-term monitoring of the mammal species at AGFO is recommended. While snap-shot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more complete understanding of the mammalian community utilizing the Monument. In particular, trapping regimes targeting mustelids and other small- to medium-sized carnivores may add species to the list documented for AGFO.

### **Species of Concern**

Of the species thus far documented at AGFO, the bats are probably of the highest interest and concern as indicator species. Many bat species are currently on sensitive species lists throughout the region. While the current survey indicates the use of the Monument by seven species during the mid- to late-summer period, the number may well be larger when migratory species are considered; although the silver-haired bat, which is a migratory species, was documented during these surveys. Regional threats to bats include renewed interest in the development of wind power projects.

## **Habitat Enhancement or Other Conservation Recommendations**

AGFO has been aggressively responding to a relatively heavy infestation of non-native and invasive plant species. Continued efforts to control such species are strongly encouraged. Although potential links between reduction of native plant diversity as a result of non-native infestations, and diversity and abundance of the insect prey base for bats, are only beginning to be examined, the conservative approach would be to assume they do indeed exist and be as pro-active as possible to re-establish and maintain native plant communities through a variety of processes including prescribed burns.

From a purely wildlife conservation/habitat 'enhancement' standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of the Monument should be avoided if possible.

## **Potential Impacts to Species**

### **Visitors**

Visitors to the Monument probably have the greatest impact on its mammalian community through vehicular strikes. As camping is not allowed, most visitors are day-use only and the vast majority explore only the areas immediately adjacent to the visitor center and trail complex in the eastern end of the Monument. As such, their potential to significantly impact the mammal species thus far documented at AGFO are considered minimal.

### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from mid-June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable.

### **Roads**

None of the mammalian species thus far documented at AGFO are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

### **Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.

## DEVILS TOWER NATIONAL MONUMENT

### ***Abstract***

Devils Tower National Monument (DETO) was surveyed for small, terrestrial mammals during the summer of 2002. Bat surveys were conducted in the summer of 2003 and wildlife cameras were deployed in summer and fall of 2003. A total of 18 terrestrial mammal species and seven bat species were documented for the Monument during these surveys. The surveys detected 58% of the previously documented species at DETO and added 12 native species to the list of mammals documented to occur at DETO. Three of the latter group were not on the park expected list for DETO. In addition, wildlife cameras documented the occurrence of non-native (domestic or feral) house cats within the Monument.

### ***Methods-Terrestrial Species***

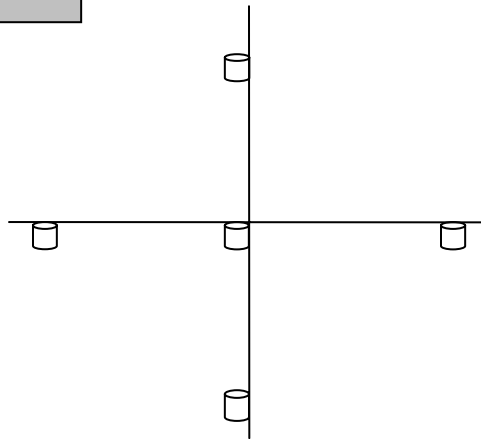
#### **Habitats/Locations Surveyed**

Ponderosa pine, riparian deciduous woodland, and grassland were the three major habitats surveyed at DETO.

#### **Survey Methods Used**

**Pitfall Stations.** Three pitfall stations (Figure 1), each consisting of five 4-gallon buckets and 20m of 10" solid metal fencing, were run in each habitat for 4 consecutive nights, providing a total of 60 trap nights per habitat for pitfalls.

Figure 1. Pitfall Station



**Live Traps.** Two Sherman live trap transects set in ponderosa pine (PP-1 and PP-2), both consisting of 40 stations (2 traps per station for a total of 80 traps per transect), were run for 3 consecutive nights, while a third ponderosa pine transect of 20 stations (PP-3; 40 traps) was run for 2 consecutive nights. Total live trap nights in ponderosa pine was 560. PP-1 was located just south of the “end of road turnaround” on West road and ran parallel to the west park boundary, at a distance of about 100m from the fence. PP-2 was placed in a roughly north-south direction, proceeding upslope northeast of the Tower. This area had been hand-thinned and slash piles were present. PP-3 was placed to the inside of the main road, between the road and the drainage in the area northwest of the tower (northern part of Graham Unit).

Two grassland transects, consisting of 40 and 80 traps (GRA-1 and GRA-2 respectively) were run for 3 nights, while 2 other grassland transects of 40 traps each (GRA-3 and GRA-4) were run for 2 consecutive nights. Total live trap nights in grassland habitat was 520. GRA-1 was in the grassland area on the south side of West road. GRA-2 was in the prairie area northeast of the Tower. GRA-3 was located in the sage shrubland area below the mesa in the southwest corner of the park. GRA-4 was located in the sage and cottonwood area close to the private campground next to the main entrance to the park.

One riparian transect of 200 traps along the park side of the Belle Fourche River was run for two consecutive nights before being pulled due to the threat of rising waters. Total live trap nights in riparian habitat was 400.

A 40-trap transect was run in the prairie dog town for three nights. Total Sherman live trap nights for the site was 1600.

Pitfall stations were associated with Sherman trap transects, or located separately, as follows:

<u>Pitfall Station</u>	<u>Sherman Transect</u>
PON-PF1	PP-1

PON-PF2	In slash area W/NW of Tower; north of Red Beds Trail
PON-PF3	PP-3
RIP-PF1	5m south of deer enclosure in drainage just west of West Road
RIP-PF2	In trees on south side of bridge over the Belle Fourche; west side of river.
RIP-PF3	Tarpot drainage; ~ 100m from road
GRA-PF1	~150m south of hiking trail leading from parking lot on West Road; 320° radial from Tower.
GRA-PF2	GRA-4
GRA-PF3	GRA-3

UTM Coordinates for each pitfall and transect are provided in Table 3.

Table 3. UTM Coordinates for pitfall stations and Sherman live trap transects at DETO.

Trap Type	Trapping Location	Zone	UTM COORDINATES	
			Easting	Northing
Pitfall Stations	PON-PF1	13T	0521479	4938318
	PON-PF2	13T	0522416	4937970
	PON-PF3	13 T	0521895	4937760
	GRA-PF1	13T	0522102	4938360
	GRA-PF2	13 T	0523690	4937491
	GRA-PF3	13 T	0522013	4936410
	RIP - PF1	13 T	0521859	4938033
	RIP -PF 2	13 T	0521579	4937526
	RIP - PF3	13 T	0523610	4937710
Sherman transects	PP-1	13 T	0521479	4938318
	PP-2	13 T	0522823	4938354
	PP-3	13 T	0521895	4937760
	GRA-1	13 T	0521559	4938344
	GRA-2	13 T	0522819	4938400
	GRA-3	13 T	0522013	1936410
	GRA-4	13 T	0523690	4937491
	RIP-1	13 T	0523610	4937710



**Wildlife Cameras.** Eight motion-sensing wildlife cameras were run at five camera stations. Cameras were generally set for a one-minute delay between images. Stations were all baited with mackerel (Appendix B). While the cameras were collectively deployed for 189 camera nights, known malfunctions reduced effective camera nights to 114.

### **Dates**

Pitfall stations were run for four consecutive nights from 18-21 July 2002.

Sherman live trap transects were run from 17-22 July 2002.

Wildlife cameras were deployed from 23 September to 6 November, 2003.

### **Observers**

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the pitfall and live trap components of the survey, while Mr. Dan Licht conducted the wildlife camera survey.

## ***Methods-Bats***

### **Habitats/Locations Surveyed**

Wooded drainages were selected for bat surveys. The first was the Tarpot Spring drainage. Surveys were conducted along the stream between the spring and the paved loop road. UTM coordinates for this site were

**13T 0523610 4937710.**

The second drainage surveyed was the major north-south drainage on the east side of the portion of the paved loop road that passes close to Tarpot Spring. UTM coordinates for this site were **13T 0521895 4937760.**

### **Survey Methods Used**

**Mist Nets.** A series of five mist nets was established along the drainage at the Tarpot Springs site. This site presented relatively dense tree canopy and nets were positioned below this canopy and across the stream.

Three nets were set over open water in the drainage paralleling and inside the west section of road leading to the Tower. Two of the nets were set below the last pullout on the right (east) side of the road before the curve to the east, and the third was set approximately 100m south of this along the same drainage.

Although the wind was brisk on both nights, the nets were protected by their positions low in the respective drainages.

**Acoustic Surveys.** Bat detectors were placed at approximately the middle of each series of nets to record echolocations from bats as they foraged along or passed over the site.

### Dates

The first site (Tarpot Spring drainage) was surveyed the night of 17 June 2003; the second the night of 18 June 2003.

### Observers

Bat surveyors were Dr. Cheryl Schmidt and Ms. Shauna Marquardt.

## Results-Terrestrial Species

### Individuals Detected

A total of 18 terrestrial mammals were documented at DETO. Table 4 provides details for mammals captured in pitfall stations, while Table 5 details those caught in the live-trap transects. The wildlife cameras added three species to the list of those documented in the combined surveys.

**Wildlife Cameras.** The 114 camera nights at DETO produced 43 identifiable images of mammals:

- White-tailed deer (*Odocoileus virginianus*) – 30
- Unknown deer (*Odocoileus* sp) – 6
- Striped skunk (*Mephitis mephitis*) – 3
- Domestic/feral cat (*Felis familiaris*) – 2
- Raccoon (*Procyon lotor*) – 1
- Cottontail rabbit (*Sylvilagus* sp) – 1

**Other Observations.** A skull of a mink, *Mustela vison*, was found near the Sherman transect in the sagebrush/grasslands at the base of the plateau in the southwest corner of the park (GRA-3). A bobcat (*Lynx rufus*) was observed along the Belle Fourche just south of the prairie dog town. A red squirrel, *Tamiasciurus hudsonicus*, was photographed near the NPS apartment complex. Nuttall's cottontail rabbits, *Sylvilagus nuttalli*, were observed at the NPS apartment complex and near the entrance to the park. Mounds produced by pocket gophers, *Geomys bursarius* or *Thomomys talpoides* (probably the latter), were observed throughout much of the park. White-tailed deer (*Odocoileus virginianus*) were observed throughout the park.

Finally, the mist net session of 17 June 2003 produced one northern flying squirrel (*Glaucomys sabrinus*), the first documentation of this species for the Monument.

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Table 4. Mammals caught in pitfalls in Ponderosa pine, Grassland and Riparian woodland habitats at Devils Tower National Monument. Blank cells indicate no captures.

Scientific Name Common Name	Ponderosa Pine (PON)			PITFALLS (PF) Grassland (GRA)			Riparian (RIP)			
	PON- PF1	PON- PF2	PON- PF3	GRA- PF1	GRA- PF2	GRA- PF3	RIP- PF1	RIP- PF2	RIP- PF3	TOTAL
<i>Sorex haydeni</i> Hayden's shrew		1					2	1	2	6
<i>Peromyscus leucopus</i> White-footed mouse									2	2
<i>Peromyscus maniculatus</i> Deer mouse		1				2				3
<i>Zapus hudsonius</i> Meadow jumping mouse									2	2

Table 5. Mammals caught in Sherman live traps in Ponderosa pine, Grassland and Riparian woodland habitats at Devils Tower National Monument. Blank cells indicate no captures.

Scientific Name Common Name	Ponderosa Pine (PP)			SHERMAN LIVE TRAPS Grassland (GRA)				Riparian (RIP)	Prairie Dog Town (PDT)	
	PP- 1	PP- 2	PP- 3	GRA- 1	GRA- 2	GRA- 3	GRA- 4	RIP-1	PDT	TOTAL
<i>Tamias minimus</i> Least chipmunk							1			1
<i>Spermophilus tridecemlineatus</i> Thirteen-lined ground squirrel								5		5
<i>Reithrodontomys megalotis</i> Western harvest mouse					1					1
<i>Peromyscus leucopus</i> White-footed mouse	4	5	3	2				8		22
<i>Peromyscus maniculatus</i> Deer mouse	6	9	3	10	1	9		3	3	44
<i>Neotoma cinerea</i> Bushy-tailed woodrat		12								12
<i>Microtus ochrogaster</i> Prairie vole						3		1		4
<i>Microtus pennsylvanicus</i> Meadow vole								4		4

**Terrestrial Mammals Captured/Observed/Photographed at Devils Tower**

*Cynomys ludovicianus* – Black-tailed prairie dog  
*Felis familiaris* – domestic/feral cat  
*Geomys bursarius* / *Thomomys talpoides* – Plains / Northern Pocket Gopher  
*Glaucomys sabrinus* – Northern flying squirrel  
*Lynx rufus* -- Bobcat  
*Mephitis mephitis* – Striped skunk  
*Microtus ochrogaster* – Prairie Vole  
*Microtus pennsylvanicus* – Meadow Vole  
*Mustela vison* -- Mink  
*Neotoma cinerea* – Bushy-tailed Woodrat  
*Odocoileus virginianus* – White-tailed deer  
*Peromyscus leucopus* – White-footed Mouse  
*Peromyscus maniculatus* -- Deer Mouse  
*Procyon lotor* -- Raccoon  
*Reithrodontomys megalotis* -- Western Harvest Mouse  
*Sorex haydeni* – Hayden's shrew  
*Spermophilus tridecemlineatus* – Thirteen-lined Ground Squirrel  
*Sylvilagus nuttalli* – Nuttall's Cottontail Rabbit  
*Tamiasciurus hudsonicus* – Red Squirrel  
*Tamias minimus* -- Least Chipmunk  
*Zapus hudsonius* – Meadow Jumping Mouse

**Results-Bats****Individuals detected**

**Mist Nets.** The five mist nets in the Tarpot Spring drainage produced three bats including one *Myotis evotis* (Western long-eared myotis), and two *Myotis lucifugus* (Little brown myotis) before the nets had to be closed due to cool temperatures.

The three nets set in the north-south drainage just east of the loop road produced 11 bats, including 1 *Myotis evotis* (Western long-eared myotis), 1 *Myotis lucifugus* (Little brown myotis), 8 *Myotis thysanodes* (Fringed myotis), and 1 *Myotis septentrionalis* (Northern long-eared myotis). Considerable bat activity was visually observed prior to darkness at this site.

**Acoustic Surveys.** Acoustic recording were screened and clean, single-species calls were selected for identification. A discriminant function model was developed base on known-species calls and then used to assign the selected calls to species. Using this process, six bat species were identified at DETO based on their echolocation calls (list below). All species captured in the mist nets, with the single exception of *Myotis*

septentrionalis, were also recorded during the acoustic surveys. The acoustic surveys detected three species not captured in the mist nets. The six species identified base on echolocation analyses were:

Big brown bat (*Eptesicus fuscus*)  
Eastern red bat (*Lasiurus borealis*); this identification supported by visual observations of free-flying bats prior to darkness  
Silver-haired bats (*Lasionycteris noctivagans*)  
Western long-eared myotis (*Myotis evotis*)  
Little brown myotis (*M. lucifugus*)  
Fringed myotis (*M. thysanodes*)

### **Species Not Documented but Possibly Present**

It is quite possible that both species of pocket gophers, *Geomys bursarius* (Plains pocket gopher) and *Thomomys talpoides* (Northern pocket gopher) are present within the Monument. Also, the badger (*Taxidea taxus*), being common and widespread across the region, probably occurs in or proximal to DETO.

### **Species on Park Expected List but Probably Not Present**

All species remaining on the expected list are reasonable to expect at DETO.

## **Recommendations to Park Management**

### **Long-term Monitoring Recommendations**

Long-term monitoring of the mammal species at DETO is recommended. While snapshot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more complete understanding of the mammalian community utilizing the Monument. In particular, trapping regimes targeting mustelids and other small- to medium-sized carnivores may add species to the list documented for DETO. Placement of such traps in the boulder fields surrounding the base of the Tower is recommended.

### **Species of Concern**

The Monument appears to support a variety of bats and carnivores, as well as several rodent species (the jumping mice and flying squirrels) that have restricted habitat requirements, all of which should be treated as species of concern. Bats are receiving considerable attention as sensitive or indicator species. Carnivores, particularly larger carnivores such as bobcats, are important for regulating populations of smaller prey species such as rodents and lagomorphs. As such, their presence in a healthy ecosystem is important. Finally, development of riparian areas throughout the western United States

is leading to considerable loss of habitat for species such as the meadow jumping mouse and, perhaps to a lesser extent, flying squirrels.

### **Habitat Enhancement or Other Conservation Recommendations**

The monument, like many of the NPS holdings within the Northern Great Plains Region, has substantial infestations of non-native plant species. Given the documented effects of invasive plants on mammalian habitat utilization (e.g. Trammel and Butler 1995), control of these invasives and restoration of native plant communities should be an ongoing priority for the Monument.

Thinning of trees to promote recruitment of trees into large-diameter size classes, combined with artificial creation of snags, could enhance availability of roosting sites for bats.

From a purely wildlife conservation/habitat 'enhancement' standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of the Monument should be avoided if possible.

### **Potential Impacts to Species**

#### **Visitors**

Potential impacts of visitors on native species include vehicular strikes on roads, spread of non-native/invasive plant propagules, and wildfire. There is also the possibility that climbers on the Tower could negatively impact any bats utilizing the crevices thereof for roosting. While crevice-dwelling bats (e.g. the fringed myotis and western long-eared myotis) were documented at DETO, it is not known whether they or any other species utilize aspects of the Tower for roosting or purposes. This is an area of research that could provide important information for the conservation of bats within the Monument.

#### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from mid-June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable.



**Roads**

None of the mammalian species thus far documented at DETO are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

**Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.

## FORT LARAMIE NATIONAL HISTORIC SITE

### ***Abstract***

Fort Laramie National Historic Site (FOLA) was surveyed for terrestrial mammals and bats during the summer of 2003. Wildlife cameras were deployed at the site during the spring of 2003. Although the combined surveys documented only 20% of the species previously documented for the site, a minimum of eight species, mostly bats, were added to the list of mammals currently documented for FOLA. A couple species of shrew species may still be added to this list, pending completion of genetic analyses at the Sternberg Museum at Ft. Hays State University.

### ***Methods-Terrestrial Species***

#### **Habitats/Locations Surveyed**

Habitats surveyed for terrestrial mammals included riparian forest, grassland, and wetland/riverine. Specific locations for pitfalls and live trap transects are provided below.

#### **Survey Methods Used**

**Pitfall Stations.** Three pitfall stations, each consisting of five 4-gallon buckets and 20m of 10" fencing, were run in each habitat (grassland and riparian forest) for 4 consecutive nights (15-18 July), providing a total of 60 trap nights per habitat for pitfalls. Pitfalls were not set in wetland/riverine habitats to reduce the risk of accidental trap deaths. Pitfall stations were associated with Sherman trap transects, or located separately, as follows:

<u>Pitfall Station</u>	<u>UTM Coordinates</u>	<u>Sherman Transect or Description</u>
RIP-PF1	13T 0536233 4672109	RIP-1 (see below)
RIP-PF2	13T 0537625 4671993	On N side of pasture road where it straightens out and heads east.
RIP-PF3	13T 0537884 4672064	In Laramie River drainage N of pasture loop road; GRA-2
GRA-PF1	T 0537706 4671989	GRA-1 (see below)
GRA-PF2	13T 130531865 4671948	S of pasture road in SE corner, just before gate
GRA-PF3	13T 0538109 4672825	GRA-3 (see below)

**Live Traps.** Eight Sherman live trap transects were established, with 200 traps in riparian forest (RIP), 180 traps in grasslands (GRA), and 160 traps in wetlands (WET). Transect locations and descriptions follow:

- RIP-1 (80 traps) – In floodplain west of road, SW of the Fort area (roughly across road from “bat house”). Transect began at Riparian Pitfall Station 1 [UTM Coordinates 13T 0536233 4672109] and proceeded at 210°.
- RIP-2 (40 traps) – In strip of woods running N/S along a small drainage that is south of the south loop road. UTM Coordinates Start: 13T 0536985 4671847 and proceeded at 140°.
- RIP-3 (80 traps) – In woods along N side of road paralleling the southern boundary fence (south pasture road). UTM Coordinates Start: 13T 0537250 4671892 and proceeded at 30°.
- GRA-1 (80 traps) – In sagebrush grassland along N side of south pasture road, just east of Grassland Pitfall 1. UTM Coordinates Start: 13T 0537706 4671989 and paralleled road.
- GRA-2 (40 traps) were set along the northern segment of the pasture road, toward the east end of the loop, and just up (out of the drainage) from Riparian Pitfall 3. UTM Coordinates Start: 13T 0537926 4672063 and paralleled bank of drainage.
- GRA-3 (20 traps) – In old horse pasture just south of highway leading to Fort; on old road leading to cottonwood stand. Across old road from Grassland Pitfall 3. UTM Coordinates 13T 0538109 4672825.
- GRA-4 (40 traps) – In NW corner of Park (area referred to by staff as “restored prairie” N/NW of old hospital), just inside fence. UTM Coordinates Start: 13T 0536182 4673064 and proceeded toward hospital.
- WET-1 (80 traps) – In western end of south edge of Park, just south of the southern part of the south pasture loop road. These wetlands are reportedly of anthropogenic origin, resulting from seepage from the irrigation canal. UTM Coordinates 13T 0536701 4671826.
- WET-2 (80 traps) – In second (eastern) drainage seep, south of pasture road. UTM Coordinates 13T 0537103 4671852.

**Wildlife Cameras.** Ten motion-sensing wildlife cameras were deployed across seven stations within FOLA; one of these cameras disappeared within a few days of placement and is assumed stolen. Stations were baited with a variety of lures including mackerel, fish oil, and fox lure (Appendix B). Cameras were generally set for a one-minute delay between images. While the remaining cameras were deployed for a total of 282 camera nights, known malfunctions reduced effective camera nights to 186.

### Dates

Pitfall stations, trap transects, and mist net / acoustic surveys were conducted the nights of 15-18 July 2003. In addition, as part of Wyoming Bat Festival 2003, a mist net was set between a couple of the buildings in the Fort proper on the night of 19 July 2003.

## Observers

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the terrestrial mammal surveys. Mr. Dan Licht performed the wildlife camera surveys.

## Methods-Bats

### Habitats/Locations Surveyed

The Laramie River was the focal point for bat surveys, although the built habitat of the Fort complex was also surveyed on two nights.

### Survey Methods Used

Mist nets were set over the mainstem and over a side pool of the Laramie River just down (straight toward the river) from the bat house. Bat detectors were run both nights at the side pool site (too much background noise at mainstem site).

### Dates

These nets were run for the nights of 16 and 17 July. On the night of 18 July, in preparation for Wyoming Bat Night at the Fort, nets were set around buildings of the Fort complex to determine good locations for demonstration nets on the night of 19 July.

## Observers

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the bat surveys.

## Results-Terrestrial Species

### Individuals Detected

A Habitat / Trap Type Summary is provided below:

#### Riparian Forest Shermans

Prairie vole (*Microtus ochrogaster*) - 3

Western harvest mouse (*Reithrodontomys megalotis*) - 5

#### Grassland Shermans

Prairie vole (*Microtus ochrogaster*) – 9

Northern grasshopper mouse (*Onychomys leucogaster*) - 3

Deer mouse (*Peromyscus maniculatus*) – 7

Western harvest mouse (*Reithrodontomys megalotis*) – 3

#### Wetland Shermans

Prairie vole (*Microtus ochrogaster*) -- 8

Western harvest mouse (*Reithrodontomys megalotis*) -- 1

Riparian Forest PitfallsPrairie vole (*Microtus ochrogaster*) – 4Masked/Hayden's shrew (*\*Sorex cinereus/haydeni*) – 2Merriam's shrew (*\*Sorex merriami*) - 3Grassland PitfallsMasked/Hayden's shrew (*\* Sorex cinereus/haydeni*) - 1

\*Shrews have been sent to the Sternberg Museum for identification; identifications provided here may change based on further examination of the specimens.

**Wildlife Cameras.** The 186 camera nights at FOLA produced 130 identifiable images of mammals as follows:

White-tailed deer (*Odocoileus virginianus*) – 94Unknown deer (*Odocoileus* sp.) – 10Horse (*Equus caballus*) – 15 (non-native species “stabled” at FOLA during winter)Raccoon (*Procyon lotor*) – 7Coyote (*Canis latrans*) – 3Cottontail rabbit (*Sylvilagus* sp.) – 1

**Other Observations.** Cottontail rabbits (*Sylvilagus* sp.) were observed at a distance throughout the Park, but identification to species was not possible. A family of raccoons (*Procyon lotor*) was observed near Riparian Pitfall #3, as was a screech owl. One of the seasonals, who was walking his dog on the south pasture road, said he had run into a couple of striped skunks (*Mephitis mephitis*). A black-tailed jackrabbit (*Lepus californicus*) was observed by Marquardt along Grassland Transect #4.

**List of Terrestrial Mammals Caught/Observed/Photographed at Fort Laramie**Black-tailed jackrabbit (*Lepus californicus*)Coyote (*Canis latrans*)Deer mouse (*Peromyscus maniculatus*)Cottontail rabbit (*Sylvilagus* sp.)Hayden's shrew (*\*Sorex haydeni*)Horse (*Equus caballus*)Masked shrew (*\*Sorex cinereus*)Merriam's shrew (*\*Sorex merriami*)Northern grasshopper mouse (*Onychomys leucogaster*)Prairie vole (*Microtus ochrogaster*)Raccoon (*Procyon lotor*)Striped skunk (*Mephitis mephitis*)Western harvest mouse (*Reithrodontomy megalotis*)White-tailed deer (*Odocoileus virginianus*)

## **Results-Bats**

### **Individuals detected**

**Mist Nets.** Ten little brown myotis (*Myotis lucifugus*; 8 lactating females, 2 males) were captured over the Laramie River. Numerous bats of this species were caught in the Fort complex on the night of 18 July; too many to even inspect upon extraction from the net. A lactating *Eptesicus fuscus* (Big brown bat) was also caught on 18 July, in a net strung between trees along the parade ground.

**Acoustic surveys.** Acoustic recording were screened and clean, single-species calls were selected for identification. A discriminant function model was developed base on known-species calls and then used to assign the selected calls to species. Using this process, five bat species were identified at FOLA based on their echolocation calls (list below). Both species captured in the mist nets were also recorded during the acoustic surveys. The acoustic surveys detected three species not captured in the mist nets. The five species identified base on echolocation analyses were:

- Big brown bat (*Eptesicus fuscus*)
- Eastern red bat (*Lasiurus borealis*)
- Silver-haired bats (*Lasionycteris noctivagans*)
- Western small-footed myotis (*Myotis ciliolabrum*)
- Little brown myotis (*Myotis lucifugus*)

### **Species Not Documented but Possibly Present**

Adams (1997) captured Townsend's big-eared bat (*Corynorhinus townsendii*) and the Western small-footed bat (*Myotis ciliolabrum*) at the Fort. This report corroborates acoustic identification of *Myotis ciliolabrum* during the 2003 survey. Both bats should be assumed to utilize the area.

The badger (*Taxidea taxus*), a common and widespread species for the Northern Great Plains region, probably occurs near or in FOLA.

### **Species on Park Expected List but Probably Not Present**

All undocumented species remaining on the park expected list, with the possible exception of the bushy-tailed woodrat, may well use the area or have used it in the past. The bushy-tailed woodrat (*Neotoma cinerea*) is questionable because this species is often associated with rock outcrops. Many of the currently undocumented species, such as the pallid bat (*Antrozous pallidus*), may be quite rare at the site, and thus would be difficult to document without prolonged monitoring efforts.

## **Recommendations to Park Management**

### **Long-term Monitoring Recommendations**

Long-term monitoring of the mammal species at FOLA is recommended. While snapshot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more complete understanding of the mammalian community utilizing the Historic Site.

Trapping regimes targeting mustelids and other small- to medium-sized carnivores may add species to the list documented for FOLA. Annual surveys of riparian areas should be conducted to monitor presence/absence of jumping mice (*Zapus* sp.). Information from areas along the front range of the Rocky Mountains in Colorado indicate that *Zapus* can be undetected in an area for a number of years, and then suddenly appear/reappear. Field observations indicate that this species can travel very quickly (and presumably for considerable distances) through thick vegetation and easily crosses streams (Schmidt, personal observation).

### **Species of Concern**

With the exception of the possibility for jumping mice (*Zapus* spp.), which have not yet been documented at FOLA and probably do not occur there, the species of most concern is the bats. FOLA has developed an excellent program to conserve and promote the bats occurring at the Fort, with the primary emphasis on the most prevalent species (the little brown myotis). Sponsorship of the annual Wyoming Bat Festival by FOLA, along with collaboration from Wyoming Game and Fish, and other agencies/entities, is a noteworthy effort in this regard.

### **Habitat Enhancement or Other Conservation Recommendations**

FOLA, like many of the NPS holdings within the Northern Great Plains Region, has substantial infestations of non-native plant species. Given the documented effects of invasive plants on mammalian habitat utilization (e.g. Trammel and Butler 1995), control of these invasives and restoration of native plant communities should be an ongoing priority for the Historic Site.

The use of the Historic Site as a wintering ground for horses from Rocky Mountain NP probably does not help with recovery and enhancement of native plant communities. Management alternatives for wintering of these animals may warrant investigation.

From a purely wildlife conservation/habitat 'enhancement' standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of FOLA should be avoided if possible.



## **Potential Impacts to Species**

### **Visitors**

Potential impacts of visitors on native species include vehicular strikes on roads, spread of non-native/invasive plant propagules, and wildfire. There is no evidence that visitation to the buildings of the Fort complex, or the activities associated with the Wyoming Bat Festival, negatively impact bats utilizing the site.

### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from mid-June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable.

### **Roads**

None of the mammalian species thus far documented at FOLA are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

### **Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.

## FORT UNION TRADING POST NATIONAL HISTORIC SITE

### ***Abstract***

Fort Union Trading Post National Historic Site (FOUN) was surveyed for small, terrestrial mammals during the summer of 2002. Bat surveys were conducted during the summer of 2003, and wildlife cameras were deployed at the site during the spring of 2004. The combined surveys documented 38% of the species previously known to exist at the site. Eight native mammal species were added to the documented list, as were two non-native mammals - the domestic dog and the house mouse. Four of the new native species (Northern short-tailed shrew, Northern pocket gopher, Western small-footed bat, and Meadow jumping mouse) were not previously identified as expected at FOUN.

### ***Methods-Terrestrial Species***

#### **Habitats/Locations Surveyed**

Riparian deciduous woodlands and grasslands were the two habitat types surveyed at FOUN. Specific locations are described below under Survey Methods Used.

#### **Survey Methods Used**

**Pitfall Stations.** Three pitfall stations, each consisting of five 4-gallon buckets and 20m of 10" fencing, were run in each habitat for 4 consecutive nights, providing a total of 60 trap nights per habitat for pitfalls. Pitfall stations were proximal to transects as follows:

<u>Pitfall Station</u>	<u>Sherman Transect (see below)</u>
PF-1 (grassland)	G-2
PF-2 (grassland)	G-1
PF-3 (riparian woodland)	RIP-1
PF-4 (grassland)	G-5
PF-5 (riparian woodland)	RIP-3
PF-6 (riparian woodland)	RIP-2, RIP-3

**Live Traps.** Three Sherman live trap transects were set in riparian deciduous woods. RIP-1, which was located along the willows of the old river channel that is southeast of the maintenance building, comprised 40 traps. RIP-2 (80 traps) and RIP-3 (40 traps) were located in later successional woodlands west of the Fort. These three transects were run for 3 nights, producing 480 total live trap nights in riparian woodland.

Six grassland transects were ultimately run, five for three nights, and the sixth (Bodmer Overlook) for two nights. G-1, was located in the rushes of the old river channel southeast of the maintenance building, and comprised 30 traps. G-2 (30 traps) was located in the brome/alfalfa on the first tier north of the old river channel (north of G-1). G-3 (30 traps) was placed in the crested wheatgrass on the second tier above the old river channel (north of G-2); and G-4 (30 traps) was in the brome along the north edge of this same tier. G-5 (40 traps) ran parallel to the highway in the restored prairie area northeast of the Fort. G-1 through G-5 were run for 3 nights. G-6 (40 traps) was established on the Bodmer Outlook which is north of the railroad tracks, and was run for two nights. Total live trap nights in grassland habitats was 560. Total live trap nights for the entire site was 1040.

UTM coordinates for the transects and pitfall stations are:

		UTM COORDINATES	
<u>Trapping Location</u>	<u>Zone</u>	<u>Easting</u>	<u>Northing</u>
GRA - PF1	13 T	0572286	5316367
GRA - PF2	13 T	0572424	5316215
GRA - PF4	13 T	0572170	5316836
RIP - PF3	13 T	0572425	5316171
RIP - PF5	13 T	0571141	5316769
RIP - PF6	13 T	0571151	5316725
GRA - 1	13 T	0572424	5316214
GRA - 2	13 T	0572402	5316299
GRA - 3	13 T	0572379	5316366
GRA - 4	13 T	0572268	5316478
GRA - 5	13 T	0572170	5316836
GRA - 6	13 T	0571827	5317802
RIP - 1	13 T	0572425	5316171
RIP - 2	13 T	0571151	5316725
RIP - 3	13 T	0571151	5316725

**Wildlife Cameras.** Five motion-sensing wildlife cameras were deployed across five stations within FOUN. Stations were baited with either mackerel or “coon lure” (Appendix B). Cameras were generally set for a one-minute delay between images. While the cameras were deployed for a total of 205 camera nights, known malfunctions reduced effective camera nights to 123.

### Dates

Pitfall stations and live trap transects were run from 5-9 August 2002. Wildlife cameras were deployed from 13 April to 24 May of 2004.

### **Observers**

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the trapping surveys. Mr. Dan Licht conducted the wildlife camera surveys.

## ***Methods-Bats***

### **Habitats/Locations Surveyed**

Due to the lack of suitable riparian areas (i.e. accessible quiet pools on the Missouri River), mist nets were set along potential flyways in wooded areas, and inside the Fort itself.

### **Survey Methods Used**

**Mist Nets.** On the night of 11 July 2003, three mist nets were set in the woods west of the Fort. On the night of 12 July, we set three nets near the south access to the Park (south of the river). On the final night, 13 July, we set four nets inside the Fort walls. One net was set up on the catwalk, and the other 3 were set on the ground in the Fort yard.

**Acoustic Surveys.** Bat detectors were run remotely at each mist netting location.

### **Dates**

Bat surveys were conducted the nights of 11-13 July 2003.

### **Observers**

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the bat surveys.

## ***Results-Terrestrial Species***

### **Individuals Detected**

A total of 18 terrestrial mammals were identified in the combined pitfall, live trap, and wildlife camera surveys. Table 6 provides details for mammals caught in pitfall stations, and Table 7 details live trap transect captures.

Table 6. Mammals captured in pitfalls at Fort Union Trading Post NHS during summer 2002.

	PITFALLS (PF)						TOTAL
	Grassland				Riparian		
Scientific Name / Common Name	PF-1	PF-2	PF-4	PF-3	PF-5	PF-6	
<i>Sorex cinereus/haydeni</i> / Masked or Hayden's shrew	2	2		8	4	4	20
<i>Blarina brevicauda</i> / Northern short-tailed shrew						1	1
<i>Perognathus fasciatus</i> / Olive-backed pocket mouse			1				1
<i>Peromyscus maniculatus</i> / Deer mouse						2	2
<i>Clethrionomys gapperi</i> / Red-backed vole				4	1	5	10
<i>Microtus pennsylvanicus</i> / Meadow vole		1		1	7	3	12
<i>Mus musculus</i> / House mouse				1		1	2
<i>Zapus hudsonius</i> / Meadow jumping mouse		1					1

Table 7. Mammals captured in Sherman live trap transects at Fort Union Trading Post NHS during summer 2002.

Scientific Name / Common Name	Grassland (G)						Riparian (RIP)			
	G-1	G-2	G-3	G-4	G-5	G-6	RIP-1	RIP-2	RIP-3	TOTAL
<i>Sorex cinereus/haydeni</i> / Masked or Hayden's shrew							3	1	1	3
<i>Blarina brevicauda</i> / Northern short-tailed shrew	2						1			3
<i>Spermophilus tridecemlineatus</i> / Thirteen-lined ground squirrel		7	8	4	2	2				23
<i>Perognathus fasciatus</i> / Olive-backed pocket mouse				2	1			2		3
<i>Reithrodontomys megalotis</i> / Western harvest mouse	2						5			7
<i>Peromyscus leucopus</i> / White-footed mouse	4						10	20	24	14
<i>Peromyscus maniculatus</i> / Deer mouse	1	11	21	4	8	2	8	17	14	86
<i>Onychomys leucogaster</i> / Northern grasshopper mouse /					1	3				4
<i>Clethrionomys gapperi</i> / Red-backed vole		1					8	26	27	9
<i>Microtus pennsylvanicus</i> / Meadow vole	4						1	11		5
<i>Mus musculus</i> / House mouse			1							1

A Habitat / Trap Type Summary is provided below.

Riparian Woodland Shermans

*Blarina brevicauda* -- 4  
*Sorex cinereus/haydeni* -- 5  
*Peromyscus leucopus*— 58  
*Peromyscus maniculatus*—88  
*Reithrodonomys megalotis* -- 5  
*Clethrionomys gapperi* – 62  
*Microtus pennsylvanicus* – 16  
*Mus musculus* – 1

Grassland Shermans

*Spermophilus richardsonii* -- 2  
*Spermophilus tridecemlineatus* – 23  
*Perognathus fasciatus* -- 1  
*Peromyscus leucopus*—4  
*Peromyscus maniculatus*—49  
*Onychomys leucogaster* -- 4  
*Reithrodontomys megalotis*—2  
*Clethrionomys gapperi* - 1  
*Microtus pennsylvanicus* -- 4

Riparian Woodland Pitfalls

*Sorex cinereus / haydeni*—16  
*Blarina brevicauda* -- 1  
*Peromyscus maniculatus*—2  
*Clethrionomys gapperi* – 10  
*Microtus pennsylvanicus* -- 11  
*Mus musculus* – 2

Grassland Pitfalls

*Sorex cinereus/haydeni* – 4  
*Perognathus fasciatus* -- 1  
*Peromyscus maniculatus*—2  
*Microtus pennsylvanicus* -- 1

**Wildlife Cameras.** The 123 camera nights at FOUN produced 43 identifiable images of mammals as follows:

- White-tailed deer (*Odocoileus virginianus*) – 29
- Unknown deer (*Odocoileus* sp.) – 5
- Cottontail rabbit (*Sylvilagus* sp.) – 6
- Domestic/Feral dog (*Canis familiaris*) – 2
- Raccoon (*Procyon lotor*) – 1

**Other Observations.** Porcupines (*Erethizon dorsatum*) were observed primarily west of the visitor's parking lot. Pocket gopher mounds were observed throughout the grassland areas of the park and, based on species distributions, should represent Northern pocket gophers (*Thomomys talpoides*).

#### **List of Terrestrial Mammals Captured/Observed/Photographed at Fort Union**

*Blarina brevicauda* – Short-tailed shrew  
*Canis familiaris* – Domestic/feral dog  
*Clethrionomys gapperi* – Red-backed vole  
*Erethizon dorsatum* -- Porcupine  
*Microtus pennsylvanicus* – Meadow Vole  
*Mus musculus* – house mouse  
*Odocoileus virginianus* – White-tailed deer  
*Onychomys leucogaster* – Grasshopper mouse  
*Perognathus fasciatus* – Olive-backed pocket mouse  
*Peromyscus leucopus* – White-footed Mouse  
*Peromyscus maniculatus* -- Deer Mouse  
*Procyon lotor* -- Raccoon  
*Reithrodontomys megalotis* -- Western Harvest Mouse  
*Sorex cinereus / haydeni* -- Masked or Hayden's shrew  
*Spermophilus tridecemlineatus* – Thirteen-lined Ground Squirrel  
*Spermophilus richardsonii* – Richardson's Ground Squirrel  
*Thomomys talpoides* -- Northern Pocket Gopher  
*Zapus hudsonius* – Meadow Jumping Mouse

## **Results-Bats**

### **Individuals detected**

Few bats were observed flying in the Fort Union area, and most of what was observed was flying very high. Two bats, both little brown myotis (*Myotis lucifugus*) were captured in the woods west of the Fort on the first night. The Fort was checked several times during the first night's netting session to see if bats could be observed flying above the structure. No bats were observed during these walk-bys.



One little brown myotis was captured and light-tagged at the net site on the south side of the river during the second night of bat surveys. However, this bat flew to a nearby cottonwood and was never observed to leave.

Two big brown bats (*Eptesicus fuscus*) were caught right before a severe thunderstorm impacted the area on the final night of mist-netting (13 July 2003). These bats, both captured in the Fort yard, were identified and released on the east (leeward) side of the Fort as the winds were too strong for them to fly on the west side. The mist nets were struck and the area was hastily departed as the deluge began.

**Acoustic Surveys.** Acoustic recordings were screened and clean, single-species calls were selected for identification. A discriminant function model was developed based on known-species calls and then used to assign the selected calls to species. Using this process, four bat species were identified at FOUN based on their echolocation calls (list below). Both species captured in the mist nets were also recorded during the acoustic surveys. The acoustic surveys detected two species not captured in the mist nets. The four species identified base on echolocation analyses were:

Big brown bat (*Eptesicus fuscus*)  
Western small-footed bat (*Myotis ciliolabrum*)  
Little brown myotis (*M. lucifugus*)  
Long-legged myotis (*M. volans*)

### ***Species Not Documented but Possibly Present***

The western jumping mouse (*Zapus princeps*) may possibly occur at FOUN, and the badger (*Taxidea taxus*) probably occurs there. Another likely resident is the snowshoe hare (*Lepus americanus*).

### ***Species on Park Expected List but Probably Not Present***

All species remaining on the park expected list have reasonable probability of occurring in or near the NHS.

## ***Recommendations to Park Management***

### **Long-term Monitoring Recommendations**

Long-term monitoring of the mammal species at FOUN is recommended. While snapshot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more

complete understanding of the mammalian community utilizing FOUN. In particular, trapping regimes targeting mustelids and other small- to medium-sized carnivores may add species to the list documented for FOUN. Placement of such traps along the banks of the river (during low flood potential periods) is recommended.

### **Species of Concern**

Of the species documented in these surveys, the bats are the primary species of concern. Bats, because of their specific habitat requirements and the sensitivity of at least some of the species to anthropogenic disturbance, are often considered indicator species. While the relative abundance of bats is probably not as high at FOUN as at other parks within the network, these populations and the habitat that supports them are no less important. Riparian habitats represent linear strips of relatively optimal habitat for bats in the northern great plains and should be managed for bats, as well as for the host of other species that rely heavily on these corridors in this region.

### **Habitat Enhancement or Other Conservation Recommendations**

Control, or preferably eradication, of non-native species – both plant and animal – within the boundary of FOUN is recommended. Presence of domestic/feral cats (should they occur) and dogs (documented in these surveys) should be aggressively addressed, as should the presence of exotic mice such as *Mus musculus*.

FOUN should be commended for its efforts to restore native plant communities within the site. The presence of species such as northern grasshopper mice, olive-backed pocket mice, and the general diversity of grassland species at the site suggests that these restoration efforts are indeed having the desired cascade effect.

From a purely wildlife conservation/habitat ‘enhancement’ standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of the Monument should be avoided if possible.

### **Potential Impacts to Species**

#### **Visitors**

Potential impacts of visitors on native species include vehicular strikes on roads, spread of non-native/invasive plant propagules, and wildfire. Since the only paved road on the major portion of FOUN (i.e. south of the highway) is the short driveway to the parking area, most vehicular strikes would probably occur on the highway itself, which forms one side of the park boundary.

#### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data

are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from mid-June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable.

**Roads**

None of the mammalian species thus far documented at FOUN are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

**Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.

## JEWEL CAVE NATIONAL MONUMENT

### ***Abstract***

Jewel Cave National Monument (JECA) was surveyed for small, terrestrial mammals during the late spring of 2003. Wildlife cameras were deployed within the monument during late spring and early summer of 2003. Bats were not surveyed because substantial information about the bat populations utilizing the Monument already exists. The combined surveys documented 57% of the terrestrial mammals previously known to inhabit the Monument. These surveys also documented the presence of four species (elk, mountain lion, mule deer, and white-footed mice) that were previously on the expected list.

### ***Methods-Terrestrial Species***

#### **Habitats/Locations Surveyed**

While burned and unburned ponderosa pine were the two distinct habitat types at JECA, the live trapping survey sampled pure burned, pure unburned, and mixed burned and unburned sites. Specific locations for live trap transects and individual box trap placements are provided in the next section.

#### **Survey Methods Used**

**Sherman Live Traps.** Six Sherman live trap transects were set at JECA. The following provides **transect name**, (number of traps), description of transect site, and the UTM coordinates for the beginning and ending point of each transect, or the direction in which the transect proceeded:

- **West-1** (200 traps) unburned drainage inside south gate and along west side of USFS Road 278, and then crossing the road to run along pine forest ridges (southern Hell Canyon area).  
UTM Coordinates      Start: 13T 0594237 4841469  
   End: 13T 0594061 4842124
- **West-2** (200 traps) up and over ridge to east, just inside south gate and east of USFS Road 278. This line was in a mix of burned and unburned areas.  
UTM Coordinates      Start: 13T 0594315 4841452  
   End: 13T 0594919 4841664
- **North-1** (80 traps) in burned area above (north of) Visitor Center.  
UTM Coordinates      Start: 13T 0594560 4843183 proceeded S/SW.
- **North-2** (40 traps) in burned/unburned area above (north of) Visitor Center.  
Started at NW corner of tank area.  
UTM Coordinates      Start: 13T 0594271 4843005 proceeded NW.

- **North-3** (40 traps) in burned/unburned area above (north of) Visitor Center. Started near the highline above the Natural Resources house and roughly paralleled the highline to the NW.  
UTM Coordinates      Start: 13T 0594230 4842908 proceed NW.
- **East** (120 traps) east-west transect close to eastern edge of Park, inside east gate off of USFS Road 278-1C. Transect started just inside gate and proceeded NW (285°) to 13T 0594957 4842108.

These transects were run for 2 nights, producing 1280 total live trap nights for the site.

**Box Traps.** Six medium-size, wire box traps (aka “Hav-A-Hearts” or “Tomahawks”) were set near the East transect, and four were set along the West-1 transect. These were baited with sardines.

**Wildlife Cameras.** Five motion-sensing wildlife cameras were deployed across five stations within JECA. Stations were baited with either fish oil or fox lure (Appendix B). Cameras were generally set for a one-minute delay between images. The cameras were deployed for a total of 75 camera nights with no known malfunctions.

### **Dates**

Live trap surveys were conducted 20-22 May 2003. Wildlife cameras were deployed in the Monument from 21 May to 4 June 2003.

### **Observers**

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the live trap surveys. Mr. Dan Licht performed the wildlife camera surveys.

## ***Results-Terrestrial Species***

### **Individuals Detected**

A total of 13 terrestrial mammal species were documented in these surveys. Four of these species are new documentations for the Monument (elk, mountain lion, mule deer, and white-footed mice).

The wire box traps did not produce any captures. All captures were in the Sherman live traps. Results are presented by habitat type (unburned, mixed, burned) below:

Ponderosa Pine – Unburned (West-1 and East Transects)

Prairie Vole (*Microtus ochrogaster*) – 20  
Meadow Vole (*Microtus pennsylvanicus*) – 8  
White-footed mouse (*Peromyscus leucopus*) — 29  
Deer Mouse (*Peromyscus maniculatus*) — 53  
Long-tailed Vole (*Microtus longicaudus*) – 1  
Least chipmunk (*Tamias minimus*) - 1

Ponderosa Pine – Mixed (West-2, North-2, and North-3)

Red-backed Vole (*Clethrionomys gapperi*) - 1  
Prairie Vole (*Microtus ochrogaster*) – 4  
Meadow Vole (*Microtus pennsylvanicus*) – 1  
White-footed mouse (*Peromyscus leucopus*) — 7  
Deer Mouse (*Peromyscus maniculatus*) — 109  
Unidentified *Peromyscus* (*Peromyscus* sp.) - 4  
Long-tailed Vole (*Microtus longicaudus*) – 2  
Unidentified *Microtus* (*Microtus* sp.) - 5  
Nuttall's Cottontail Rabbit juvenile (*Sylvilagus nuttali*) - 1  
Least chipmunk (*Tamias minimus*) - 6

Ponderosa Pine – Burned (North-1)

White-footed mouse (*Peromyscus leucopus*) — 4  
Deer Mouse (*Peromyscus maniculatus*) — 33  
Long-tailed Vole (*Microtus longicaudus*) – 2  
Red Squirrel (*Tamiasciurus hudsonicus*) - 1

**Wildlife Cameras.** The 75 camera nights at JECA produced eight identifiable images of mammals:

Mule deer (*Odocoileus hemionus*) – 6  
Unknown deer (*Odocoileus* sp.) – 1  
Cottontail rabbit (*Sylvilagus* sp.) – 1

**Other Observations.** Both Nuttall's and Eastern cottontails (*Sylvilagus nuttalli* and *S. floridanus*, respectively) were observed along the transects. Elk (*Cervus elaphus*) were observed just outside the Park fence off of USFS Road 278-C. Mule deer were also observed at the east end of the Park. Mountain lion (*Felis concolor*) tracks were observed in a mud puddle just inside the south gate on USFS Road 278.

**List of Terrestrial Mammals Captured/Observed/Photographed at Jewel Cave**

Deer mouse (*Peromyscus maniculatus*)  
Eastern cottontail (*Sylvilagus floridanus*)  
Elk (*Cervus elaphus*)  
Least chipmunk (*Tamias minimus*)  
Long-tailed vole (*Microtus longicaudus*)  
Meadow vole (*Microtus pennsylvanicus*)  
Mountain lion (*Felis concolor*)  
Mule deer (*Odocoileus hemionus*)  
Nuttall's cottontail rabbit juvenile (*Sylvilagus nuttali*)  
Prairie vole (*Microtus ochrogaster*)  
Red-backed vole (*Clethrionomys gapperi*)  
Red squirrel (*Tamiasciurus hudsonicus*)  
White-footed mouse (*Peromyscus leucopus*)

***Species Not Documented but Possibly Present***

Northern pocket gophers (*Thomomys talpoides*) may occur in low-lying areas if pockets of suitably deep soil exist. Badgers (*Taxidea taxus*) may also occupy such areas.

***Species on Park Expected List but Probably Not Present***

Ord's kangaroo rat (*Dipodomys ordii*) is on the park expected list but most likely does not occupy the area. These rodents are typical of lower elevation, relatively xeric grasslands with loose, sandy soils. The same is probably true of the other heteromyids on the expected list (i.e. *Chaetodipus hispidus* and *Perognathus fasciatus*) although they do occasionally occur in more mesic areas of grasslands.

***Recommendations to Park Management*****Long-term Monitoring Recommendations**

Long-term monitoring of the mammal species at JECA is recommended. While snapshot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more complete understanding of the mammalian community utilizing the Monument. In particular, trapping regimes targeting mustelids and other small- to medium-sized carnivores may add species to the list documented for JECA.

### **Species of Concern**

The only species documented in these surveys that may be considered a species of concern is the mountain lion. Increased sightings of mountain lions in the Black Hills region over the last several years suggest that the Black Hills population may be increasing. However, it may also be that human-cat interactions have increased as a result of increased human population in the Hills region, instead of increased mountain lion population.

### **Habitat Enhancement or Other Conservation Recommendations**

Restoration of forests with three-dimensional structure will be important for many species of small- to mid-sized mammals, as well as the larger mammals which prey upon them. While the mixed burned and unburned habitat supported the greatest diversity of small mammals, all three habitats displayed a preponderance of deer mice, a species which appears to be able to dominate simple-structure habitats.

From a purely wildlife conservation/habitat 'enhancement' standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of the Monument should be avoided if possible.

### **Potential Impacts to Species**

#### **Visitors**

Potential impacts of visitors on native species include vehicular strikes on roads, spread of non-native/invasive plant propagules, and wildfire. The impacts of wildfire on small mammal populations are alluded to above.

#### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from mid-June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable, and those should be planned so that smoke does not blow toward the known hibernacula within the Monument.



### **Roads**

None of the mammalian species thus far documented at JECA are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

### **Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.

## KNIFE RIVER INDIAN VILLAGES

### NATIONAL HISTORIC SITE

#### ***Abstract***

Knife River Indian Villages National Historic Site (KNRI) was surveyed for small, terrestrial mammals during the summer of 2002. Bat surveys were conducted in mid-summer of 2003, and wildlife cameras were deployed at KNRI during the spring of 2004. The combined surveys documented presence of 20% (10 out of 25) of the mammals previously documented for the park. The surveys added at least seven native mammals, mostly bats, to the documented list for the park, as well as one non-native species (domestic dog).

#### ***Methods-Terrestrial Species***

##### **Habitats/Locations Surveyed**

Forested floodplain and mixed-grass prairie were the two major habitats sampled in these surveys.

##### **Survey Method Used**

**Live Traps.** Sherman live trap transects was the only method used to capture small, terrestrial mammals. Pitfalls were not used to avoid potential impacts on buried artifacts. Eight Sherman live trap transects were set at this site; 3 (RIP-1 through RIP-3) in the forested floodplain, 1 (G-2) along a seasonal creek in the western portion of the site, and 4 (G-1, and G-3 through G-5) in various conditions of mixed-grass prairie:

- **RIP-1** (80 traps) open woodlands inside Loop Trail in the SE corner of the park.
- **RIP-2** (80 traps) more closed woodland inside the S end of the loop in the north end of the park
- **RIP-3** (80 traps) mature forest in hairpin part of loop in N end of park
- **G-1** (80 traps) running generally upslope (N) in the native prairie at the N end of the park
- **G-2** (20 traps) along an intermittent stream just south of the native prairie area
- **G-3** (80 traps) in restored prairie southeast of the maintenance facility
- **G-4** (40 traps) along Knife River near fishing hole gate
- **G-5** (40 traps) between woods and river just south of the hairpin in N end of park

These transects were run for 2 nights, producing 1000 total live trap nights for the site.

UTM Coordinates for each transect are provided below:

<b>Trapping</b>		<b>UTM COORDINATES</b>	
<b>Location</b>	<b>Zone</b>	<b>Easting</b>	<b>Northing</b>
G - 1	13 T	0319576	5249529
G - 2	13 T	0319699	5249352
G - 3	13 T	0319517	5247927
G - 4	13 T	0319835	5246114
G - 5	13 T	0319909	5249764
RIP - 1	13 T	0320717	5244964
RIP - 2	13 T	0319895	5248176
RIP - 3	13 T	0319663	5249937

**Wildlife Cameras.** Five motion-sensing wildlife cameras were deployed across five stations within KNRI. Stations were baited with either fish oil or mackerel (Appendix B). Cameras were generally set for a one-minute delay between images. The cameras were deployed for a total of 215 camera nights; however, known malfunctions reduced the number of effective camera nights to 129.

### **Dates**

Live trap transects were run the nights of 9-11 August 2002.

Wildlife cameras were deployed from 14 April to 27 May of 2004.

### **Observers**

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the trapping survey. Mr. Dan Licht conducted the wildlife camera survey.

### **Methods-Bats**

#### **Habitats/Locations Surveyed**

Floodplain forest habitat was surveyed for bats because the river was too wide, deep and fast for effective netting.

#### **Survey Methods Used**

**Mist nets.** Thirteen mist nets were deployed across four sites within the forested floodplain at the north end of KNRI. Four mist nets were set over the road on the northwest corner of the hairpin loop in the northern portion of the woods that are

northeast of the maintenance buildings. Four mist nets were run just south of this on a subsequent night. Five mist nets were set up and monitored over puddles in the road, and over the road itself where the trees formed a closed canopy, right at the entrance to the same patch of woods (over the road going to the archaeological site west of the woods, and in the open area containing the interpretive display).

**Acoustic Surveys.** Bat detectors were used to record echolocation pulses of free-flying bats at each mist net site. Detectors were set up as soon as the mist nets were in place, and shut down prior to striking the nets.

### Dates

Mist net and acoustic surveys were conducted the nights of 6, 7, and 9 July 2003. A series of thunderstorms rolled through the area on the night of 8 July, preventing any sampling from occurring that night.

### Observers

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the bat surveys.

## Results-Terrestrial Species

### Individuals Detected

A total of 8 species of small, terrestrial mammals were documented by the trapping survey (Table 8). The wildlife cameras added five mid-sized mammals to the overall list.

Table 8. Small mammals captured in live trap transects at KNRI during summer 2002.

<b>Scientific Name / Common Name</b>	<b>Transects</b>								<b>TOTAL</b>
	<b>G-1</b>	<b>G-2</b>	<b>G-3</b>	<b>G-4</b>	<b>G-5</b>	<b>RIP-1</b>	<b>RIP-2</b>	<b>RIP-3</b>	
<i>Sorex cinereus/haydeni</i> Masked or Hayden's shrew			2				2		4
<i>Blarina brevicauda</i> Northern short-tailed shrew								2	2
<i>Spermophilus tridecemlineatus</i> Thirteen-lined ground squirrel	2		8						10
<i>Peromyscus leucopus</i> White-footed mouse		4		4		30	17	32	87
<i>Peromyscus maniculatus</i> Deer mouse	1	4	3	2	7	13		3	33
<i>Clethrionomys gapperi</i> Red-backed vole							17	5	22
<i>Microtus pennsylvanicus</i> Meadow vole			1				1		2
<i>Zapus hudsonius</i> Meadow jumping mouse				1		5		1	7

A Habitat / Trap Type Summary is provided below.

Forested Floodplain Shermans

*Blarina brevicauda* -- 2  
*Sorex cinereus/haydeni* -- 2  
*Peromyscus leucopus*— 79  
*Peromyscus maniculatus*—16  
*Clethrionomys gapperi* – 22  
*Microtus pennsylvanicus* – 1  
*Zapus hudsonius* - 6

Grassland Shermans

*Spermophilus tridecemlineatus* – 10  
*Peromyscus leucopus*— 8  
*Peromyscus maniculatus*—17  
*Microtus pennsylvanicus* -- 1

**Wildlife Camera.** The 129 camera nights produced 63 identifiable images of mammals as follows:

White-tailed deer (*Odocoileus virginianus*) – 53  
Unknown deer (*Odocoileus* sp.) – 3  
Red Fox (*Vulpes vulpes*) -- 3  
Cottontail rabbit (*Sylvilagus* sp.) – 1  
Domestic/Feral dog (*Canis familiaris*) – 1  
Raccoon (*Procyon lotor*) – 1  
Coyote (*Canis latrans*) -- 1

**Alphabetical List of Mammals Captured/Observed at Knife River**

*Blarina brevicauda* – Short-tailed shrew  
*Canis familiaris* – Domestic dog  
*Canis latrans* -- Coyote  
*Clethrionomys gapperi* – Red-backed vole  
*Microtus pennsylvanicus* – Meadow Vole  
*Odocoileus virginianus* – White-tailed deer  
*Peromyscus leucopus* – White-footed Mouse  
*Peromyscus maniculatus* -- Deer Mouse  
*Procyon lotor* -- Raccoon  
*Sorex cinereus / haydeni* – Masked or Hayden's shrew  
*Spermophilus tridecemlineatus* – Thirteen-lined Ground Squirrel  
*Vulpes vulpes* – Red fox

*Zapus hudsonius* – Meadow Jumping Mouse**Results-Bats****Individuals detected**

**Mist Nets.** On the night of 6 July, large bats, possibly Big brown bats (*Eptesicus fuscus*) or Hoary bats (*Lasiurus cinereus*) were observed flying above or near the tree canopy early in the session, and then dropped below the canopy later in the session. These observations were made a short distance south of where the nets were actually set. There was a distinct pulse of activity from approximately 9:30-10:00pm, after which there was virtually no activity observed or “heard” with the bat detectors. The temperature dropped quickly following sunset and the nets were pulled at 11:30pm due to low temperatures. These nets produced only one bat, a Little brown bat (*Myotis lucifugus*). Deer were active in the area throughout the session and one managed to run through and destroy a net right toward the end of the netting session.

On the night of 7 July, four mist nets were set around the area just south of the previous net sets. This was the area where high bat activity was observed on the night of the 6<sup>th</sup>. However, as the peak activity time of 9:30-10:00pm came and went, no bats were observed flying; nor did the bat detectors record any activity. No bats were captured on this night.

On the night of 9 July, the 5 nets (2 singles, and 1 triple zig-zag) over puddles in the road, and over the road where the trees formed a closed canopy, right at the entrance to the same patch of woods (over the road going to the archaeological site west of the woods, and in the open area containing the interpretive display), produced two bats. A Hoary bat (*Lasiurus cinereus*) and a Little brown bat (*Myotis lucifugus*), were captured at this site; both were lactating females.

**Bats Captured at KNRI:** Little brown bat (*Myotis lucifugus*) --2  
Hoary bat (*Lasiurus cinereus*) -- 1

**Acoustic Surveys.** Acoustic recordings were screened and clean, single-species calls were selected for identification. A discriminant function model was developed based on known-species calls and then used to assign the selected calls to species. Using this process, five bat species were identified at KNRI based on their echolocation calls (list below). Only one of the species captured in the mist nets were also recorded during the acoustic surveys. The acoustic surveys detected four species not captured in the mist nets. The five species identified base on echolocation analyses were:

Big brown bat (*Eptesicus fuscus*)  
Silver-haired bat (*Lasionycteris noctivagans*)  
Western small-footed bat (*Myotis ciliolabrum*)  
Little brown myotis (*M. lucifugus*)

Northern long-eared myotis (*M. septentrionalis*)

### **Species Not Documented but Possibly Present**

The northern pocket gopher (*Thomomys talpoides*), Richardson's ground squirrel (*Spermophilus richardsonii*), and badger (*Taxidea taxus*) are all species which probably occur in or proximal to KNRI.

### **Species on Park Expected List but Probably Not Present**

All species remaining on the expected list at this time are viable candidates for occurring on the site.

## **Recommendations to Park Management**

### **Long-term Monitoring Recommendations**

Long-term monitoring of the mammal species at KNRI is recommended. While snapshot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more complete understanding of the mammalian community utilizing KNRI. In particular, trapping regimes targeting mustelids and other small- to medium-sized carnivores may add species to the list documented for KNRI. Placement of such traps along the banks of the river (during low flood potential periods), and along the bluffs at the northern end of KNRI is recommended.

### **Species of Concern**

Of the species documented in these surveys, the bats are the primary species of concern. Bats, because of their specific habitat requirements and the sensitivity of at least some of the species to anthropogenic disturbance, are often considered indicator species. While the relative abundance of bats is probably not as high at KNRI as at other parks within the network, these populations and the habitat that supports them are no less important. Riparian habitats represent linear strips of relatively optimal habitat for bats in the northern great plains and should be managed for bats, as well as for the host of other species that rely heavily on these corridors in this region.

### **Habitat Enhancement or Other Conservation Recommendations**

Control, or preferably eradication, of non-native species – both plant and animal – within the boundary of KNRI is recommended. Presence of domestic/feral cats (should they occur) and dogs (documented in these surveys) should be aggressively addressed.

From a purely wildlife conservation/habitat 'enhancement' standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of KNRI should be avoided if possible.

## **Potential Impacts to Species**

### **Visitors**

Potential impacts of visitors on native species include vehicular strikes on roads, spread of non-native/invasive plant propagules, and wildfire.

### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from mid-June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable.

### **Roads**

None of the mammalian species thus far documented at KNRI are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

### **Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.



## MISSOURI NATIONAL RECREATIONAL RIVER

### ***Abstract***

The Missouri National Recreational River (MNRR) was surveyed for the presence of mammals during the summer of 2004. Habitats inventoried included grasslands, bluffs, and riverine woodlands. Sites for inventories were chosen primarily due to their accessibility, as well as the presence of a mixture of the three habitat types (woodland, grassland, and bluff), as specified by personnel at the National Park Service. The major areas for surveys included sites in and around Niobrara State Park (NSP), Southshore Recreation Area (SRA) adjacent to Lake Lewis and Clark, and Ponca State Park (PSP). Additionally, data are included for mammal surveys conducted on Goat Island by personnel from the University of South Dakota and a small mammal survey conducted by Dr. Russell Benedict (Central College, Pella, IA) under the auspices of Nebraska Game and Parks Commission. No unexpected species were documented.

### ***Methods-Terrestrial Species***

#### **Habitats/Locations Surveyed**

##### **Niobrara State Park**

The Park Superintendent provided permission for access to all areas of the park. Habitat within the park was very typical of areas surrounding the western end of the Missouri National Recreation River and the park is bounded by both the Missouri and Niobrara Rivers. The grassland habitat (GRA-1) that was surveyed was on a west facing slope approximately 1 km west of the park headquarters, and can be typified as a native mid-grass prairie. The bluff site (BLF-1) was approximately 3 km north of the park headquarters just below the top of the last ridge leading towards the river. The north facing slope was dominated by eastern red cedar mixed with various hardwoods and sumac. The woodland site (WLD-1) was located at the bottom of the bluff. Paralleling an old railroad line, this site was heavily wooded with oaks and hickory with very little under story.

All three sites were sampled in a similar manner, with a single transect of 60 traps set about 10 meters apart set in an approximately linear array in each habitat. Transects were run for two consecutive nights for a total of 120 trap nights per habitat. Rainfall early in the evening on the second night seemed to increase both trapping success and diversity within the grassland site.

Pitfalls (GRAPIT and WLDPIT, grassland and woodland pitfall, respectively) were set directly adjacent to the transects in the woodland and grassland habitat and left in place for three consecutive nights.

Weather during the sampling period was very hot and humid and extremely windy. Daily highs were in the low 100s and nightly lows in the upper 70s.

	UTM Zone	<u>Coordinates</u>		End	
		<u>Easting</u>	<u>Northing</u>	<u>Easting</u>	<u>Northing</u>
GRA-1	14	623313	4744360	623185	4744439
BLF-1	14	575977	4735724	576106	4735504
WLD-1	14	575545	4735901	575249	4735958
GRAPIT	14	575977	4733838		
WLDPIT	14	575249	4735965		

### Southshore Recreation Area

Directly adjacent to Lake Lewis and Clark, this area was a mosaic of patchy grassland on ridge tops with bluff habitat on the extreme slopes of each bluff and typical riverine woodland habitat in the lower elevations. This area was chosen partly because of recent efforts to restore open grasslands in this area through the use of prescribed burns. The grassland habitat surveyed had been burned in the spring of both 2002 and 2003. Unlike most of the surround grasslands that were dominated by smooth brome, this grassland area was typified by big and little bluestem and western wheatgrass. Because of the patchy habitat, two transects were set up in each habitat with each transect consisting of 20 traps, for a total of 40 traps per habitat. Transects were run for 3 consecutive nights for a total of 120 trap nights for each habitat.

Pitfalls were set adjacent to trap lines in both the grassland and woodland habitat. Pitfalls were set up on 23 July and monitored for three consecutive nights for a total of 15 trap nights for each habitat.

Weather continued hot and humid the first day (22 July). However, a strong front moved through on the afternoon of 23 July, dropping high temperatures into the upper 70s and lows in the mid 50 for the remainder of the sampling at this site.

	UTM Zone	<u>Coordinates</u>		End	
		<u>Easting</u>	<u>Northing</u>	<u>Easting</u>	<u>Northing</u>
GRA-1	14	623313	4744360	623185	4744439
GRA-2	14	623311	4744526	623284	4744397
BLF-1	14	623542	4744533	623642	4744474
BLF-2	14	623606	4744557	623599	4744606
WLD-1	14	635282	4744329	623603	4744274
WLD-2	14	623593	4744260	623707	4744200
GRAPIT	14	623270	4744394		
WLDPIT	14	623580	4744282		

**Ponca State Park**

Ponca State Park is typical of the eastern end of the Missouri National Recreational River with heavily wooded hillsides, dominated by bur oak, and bluffs extending down to the banks of the Missouri River. Along the northwestern boundary of the park, the bluffs do not extend all of the way to river but are separated by a large expanse of restored floodplain grassland. Additionally, along the river in the extreme northern end of the park a cottonwood woodland occupies the undulating sandy soils along the river. Because of the variability of the woodland cover within this park, two transects were set up for wooded habitats – oak woodland and cottonwood woodland. Bluff sites were selected on upland areas with a heavy concentration of eastern red cedar to mimic previous sites. Because all upland grassy areas were dominated by smooth brome, the restored grassland at the base of the bluffs was chosen for the grassland site. As with Niobrara State Park, the superintendent at Ponca State park granted permission to sample throughout the park.

Trap lines were established as at Southshore Recreation area with 2 lines of traps in each habitat, however this time 30 traps were used in each transect. Sampling occurred over two consecutive nights for a total of 120 trap nights per habitat.

Pitfalls were located adjacent to the trap lines with a pitfall located in the grassland habitat and the cottonwood woodlands habitat and were monitored for three consecutive nights.

Weather continued cool with intermittent periods of rain. Highs were in the high 70s, lows in the upper 40s and low 50s.

	UTM	<u>Coordinates</u>			
		Start		End	
	<u>Zone</u>	<u>Easting</u>	<u>Northing</u>	<u>Easting</u>	<u>Northing</u>
GRA-1	14	687221	4720010	687269	4719790
GRA-2	14	687171	4720008	687204	4719773
BLF-1	14	686216	4719754	686060	4719900
BLF-2	14	686539	4719658	686517	4719907
WLD-1	14	687690	4720865	687569	4720827
WLD-2	14	686596	4719512	686625	4719649
GRAPIT	14	687219	4720024		
WLDPIT	14	687463	4720922		

**Goat Island**

These data were obtained from Dr. James Novak, University of South Dakota. He and his students have been conducting a long-term study of the small mammals of this island and the data presented here represent fieldwork from May, June and July 2004. Other data are available upon request. Three study sites have been set up on the island with each site consisting of three parallel trap lines.

**Coordinates for the Corners of Each Study Area**

	<u>UTM Zone</u>	<u>Easting</u>	<u>Northing</u>
G1	14	657392	4736223
	14	657493	4736226
	14	657494	4736166
	14	657393	4736364
G2	14	657531	4736297
	14	657529	4736356
	14	657631	4736300
	14	657630	4736359
G3	14	646499	4736434
	14	656585	4736383
	14	656625	4736449
	14	656532	4736501

**Survey Method Used**

At each of the three major sites listed above, lines of Sherman Live Traps were set in each of the three habitat types. The location of each transect was chosen so as to minimize edge effect and thereby specifically identify species common to that particular habitat. Transects consisted of 20 to 60 traps each that were monitored for either two or three consecutive nights, resulting in 120 trap nights for each habitat at each site. Because of the fragmented nature of the habitats at some sites, the length (number of traps) of individual transects varied. Additional traps were occasionally set at specific locations for the purpose of attempting to capture targeted species that might not be common in the three designated habitats. The overall inventory represents 1096 trap nights for Sherman Live Traps.

Pitfall traps were also set in two habitats at each of the three trapping sites – woodland and grassland. Pitfall arrays consisted of 5 – 4 gallon buckets connected by an “X” of 10m X 10m fencing (10” aluminum flashing) with a bucket at each end of the “X” and the fifth bucket in the middle. Pitfall traps were monitored for three consecutive nights for a total of 15 trap nights for each habitat at each site. The overall inventory represents 90 trap nights for pitfall traps.

## **Dates**

Niobrara State Park – 19 July to 23 July 2004

Southshore Recreation Area – 22 July to 25 July 2004

Ponca State Park – 26 July to 28 July 2004;

Data for Goat Island – May, June and July 2004

## **Observers**

Dr. Philip Sudman, Diane Sudman, Chad Stasey – Tarleton State University

Dr. James Novak, Rachel DeMots, Aaron Gregor – University of South Dakota

Dr. Russell Benedict – Central College (Pella Iowa)

## ***Methods-Bats***

### **Habitats/Locations Surveyed**

#### **Niobrara State Park**

Bat netting was attempted two of the three nights spent at this area. However high winds and a severe storm hampered the efforts, with no bats captured, seen or heard. Nets were set around a small pond within the state park (UTM Zone 14, Easting 577018, Northing 4732810) as well as next to the bridge over the Niobrara River on Highway 12 (14, Easting 544693, Northing 4732984).

#### **Southshore Recreation Area**

Bat netting was only attempted one night next to a beaver pond within the recreation area. Bats were seen, but none captured. UTM Zone 14, Easting 623465, Northing 4744920.

#### **Ponca State Park**

Bat nets were set up every evening in different habitats including a clearing along a ridge top (UTM Zone 14, Easting 686519, Northing 4719900), a clearing in the archery area (14, Easting 686817, Northing 4717938), and beneath limbs overhanging the edge of the Missouri River (14, Easting 687721, Northing 4719021). While numerous bats were seen in the archery range and along the river, no captures were made. It was decided to return with a bat detector to document bats present.

A second trip was made to Ponca State Park to again attempt to capture bats. In addition to mist netting, an Anabat detector was used to record bat calls. Mist nets were set up at the archery range at Ponca State Park on the nights of 17 and 18 August; UTM coordinates Zone 14, Easting 686817, Northing 4717938.

## **Survey Methods Used**

Mist nets and Anabat detection system.

## **Dates**

Niobrara State Park – 19 - 23 July 2004

Southshore Recreation Area – 22 - 25 July 2004

Ponca State Park – 26 - 28 July 2004; 17 – 19 August 2004

## **Observers**

Dr. Philip Sudman, Diane Sudman, Chad Stasey – Tarleton State University

Dr. Russell Benedict – Central College (Pella Iowa)

## ***Results-Terrestrial Species***

### **Individuals Detected**

#### **Capture Data for Niobrara, Southshore and Ponca:**

##### Niobrara State Park (Shermans)

###### Bluff

*Peromyscus leucopus* – 6

###### Woodland

*Peromyscus leucopus* – 36

###### Grassland

*Chaetodipus hispidus* – 1

*Microtus ochrogaster* – 2

*Peromyscus leucopus* – 4

*Peromyscus maniculatus* – 18

*Reithrodontomys megalotis* – 1

*Spermophilus tridecemlineatus* – 1

##### Niobrara State Park (Pitfalls)

Woodland - No mammal captures

###### Grassland

*Blarina brevicauda* – 3

##### Southshore (Shermans)

###### Bluff

*Microtus pennsylvanicus* – 1

*Peromyscus leucopus* – 32

*Peromyscus maniculatus* – 11

Southshore (Shermans; cont.)

Woodland

*Peromyscus leucopus* – 52

*Peromyscus maniculatus* – 9

Grassland

*Microtus ochrogaster* – 1

*Peromyscus leucopus* – 34

*Peromyscus maniculatus* – 8

Southshore (Pitfalls)

Woodland - No mammal captures

Grassland

*Microtus pennsylvanicus* – 1

Ponca State Park (Shermans)

Bluff

*Blarina brevicauda* – 1

*Microtus pennsylvanicus* – 2

*Peromyscus leucopus* – 68

*Peromyscus maniculatus* – 5

*Reithrodontomys megalotis* – 2

Woodland

*Peromyscus leucopus* – 64

*Peromyscus maniculatus* – 14

Grassland

*Peromyscus leucopus* – 10

*Peromyscus maniculatus* – 15

*Reithrodontomys megalotis* – 4

Ponca State Park (Pitfalls)

Woodland

*Reithrodontomys megalotis* – 1

Grassland

*Perognathus flavescens* – 1

**Total Captures – Niobrara, Southshore and Ponca:**

<i>Blarina brevicauda</i>	3
<i>Chaetodipus hispidus</i>	1
<i>Microtus ochrogaster</i>	3
<i>Microtus pennsylvanicus</i>	4
<i>Peromyscus leucopus</i>	307
<i>Peromyscus maniculatus</i>	87
<i>Perognathus flavescens</i>	1
<i>Reithrodontomys megalotis</i>	8
<i>Spermophilus tridecemlineatus</i>	<u>1</u>
Total	415

Total Trapnights = 1080 (Sherman traps) and 90 (pitfalls)

Total Captures = 409 (Sherman traps) and 6 (pitfalls)

Trapping Success = 37.9% (Sherman traps) and 6.7% (pitfalls)

## Other mammals documented:

*Sylvilagus floridanus* – prevalent at all sites

*Geomys bursarius* – gopher mounds evident at all localities

*Odocoileus virginianus* – deer seen in all localities, and several sheds identified

*Odocoileus hemionus* – one mule deer shed found at Niobrara State Park

*Spermophilus franklinii* – seen at Clay Co. Park SW of Vermillion, SD

*Scalopus aquaticus* – mole runs evident at all sites

*Sciurus niger* – prevalent at Southshore RA and Ponca State Park

*Mephitis mephitis* – skunks seen at night in Ponca State Park

*Castor canadensis* – beaver dam at Southshore, and beaver sited in pond.

Numerous dams identified east of the Niobrara River at Niobrara State Park

*Ondatra zibethicus* – muskrat dens noted along Niobrara River

*Procyon lotor* – raccoons seen at all three study sites

*Taxidea taxus* – badger digs and dens identified at Niobrara State Park

*Canis latrans* – coyotes heard nightly at all sites



**Capture Data for Goat Island:**

## G1 May 2004

<i>Microtus pennsylvanicus</i>	1	
<i>Peromyscus leucopus</i>	76	
<i>Sorex cinereus</i>	1	Total trap nights=111

## G1 June 2004

<i>Peromyscus leucopus</i>	124	
<i>Sorex cinereus</i>	2	Total trap nights=150

## G1 July 2004

<i>Peromyscus leucopus</i>	188	Total trap nights=210
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## G2 June 2004

<i>Microtus pennsylvanicus</i>	3	
<i>Peromyscus leucopus</i>	1	Total trap nights=90

## G2 July 2004

<i>Microtus pennsylvanicus</i>	3	Total trap nights=90
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## G3 May 2004

<i>Peromyscus leucopus</i>	10	Total trap nights=90
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## G3 June 2004

<i>Microtus ochrogaster</i>	3	
<i>Peromyscus leucopus</i>	53	Total trap nights=96

## G3 July 2004

<i>Microtus ochrogaster</i>	6	
<i>Peromyscus leucopus</i>	102	Total trap nights=148

## Total Captures

<i>Microtus ochrogaster</i>	9
<i>Microtus pennsylvanicus</i>	7
<i>Peromyscus leucopus</i>	554
<i>Sorex cinereus</i>	3
Total	573

Total Trap nights = 985 (Sherman traps)

Total Captures = 573 (Sherman traps)

Trapping Success = 58.2% (Sherman traps)

Additional species captured later in the trapping season:

*Blarina brevicauda*

*Scalopus aquaticus*

## **Results-Bats**

### **Individuals detected**

*Pipistrellus subflavus* 1

*Lasionycterus noctivagans* 1

*Eptesicus fuscus* 2

These same species were documented by Dr. Russell Benedict, Central College, Pella Iowa at Ponca State Park in June 2004.

## **Species Not Documented but Possibly Present**

*Didelphis virginiana*

*Cryptotis parva*

*Myotis keenii*

*Myotis lucifugus*

*Lasionycteris noctivagans*

*Lasiurus borealis*

*Lasiurus cinereus*

*Lepus californicus*

*Marmota monax*

*Onychomys leucogaster*

*Synaptomys cooperi*

*Zapus hudsonius*

*Erethizon dorsatum*

*Vulpes velox*

*Vulpes vulpes*

*Urocyon cinereoargenteus*

*Mustela frenata*

*Mustela vison*

*Spilogale putorius*

*Felis concolor*

*Felis rufus*

## ***Species on Park Expected List but Probably Not Present***

*Microsorex hoyi*

*Lepus townsendii*

*Reithrodontomys montanus*

*Lutra canadensis*

## ***Recommendations to Park Management***

### **Long-term Monitoring Recommendations**

As mentioned in the introduction, Dr. Russell Benedict also conducted small mammal surveys along the Missouri River in Nebraska in May and June 2004. He has indicated that no additional species can be added to the list contained herein. Trap success and species diversity during the May-June 2004 survey were lower. Based on this information as well as information from Dr. Novak's students at the University of South Dakota, it is recommended that any future surveys for terrestrial mammals be conducted in the fall, as captures per unit effort increase from mid summer into mid-fall, as does diversity of species captured. Additionally, based on personal experience, captures of small shrews, especially *Sorex*, are greater in spring. Therefore, it is recommended that future monitoring include spring sampling as well as fall.

### **Species of Concern**

Although no species are of specific concern, the disappearance of native grassland habitat in the eastern portion of the MNRR is cause for concern for species associated with this habitat. For instance, no *Onychomys* were captured in this survey – a species that is usually moderately abundant in grassland habitats. Additionally, small shrews such as *Sorex cinereus* should be abundant in the habitats monitored; however none were captured in this survey of the May-June 2004 surveys.

Another species absent from this survey, but documented in recent years below the Fort Randall Dam, is *Synaptomys cooperi*. This species is dependent on wetland habitats within the grassland ecosystem. Because of the invasion of woody vegetation into these habitats, this species has greatly decreased in numbers.

A final species of concern is *Spilogale putorius*. This skunk has decreased in numbers over its entire range.

### **Habitat Enhancement or Other Conservation Recommendations**

Retention and restoration of grassland habitats throughout the park are recommended. Encroachment of woody vegetation into native grassland areas, as well as the conversion

of grasslands into croplands has greatly diminished available habitat for many grassland species. Additionally, maintenance of wetland habitats within the grassland areas is recommended – these microhabitats should be maintained with a minimum of woody vegetation.

## **Potential Impacts to Species**

### **Visitors**

No direct, negative impact of visitors on mammal diversity within the park system is apparent.

### **Prescribed Fire**

Because the highest terrestrial diversity is present within the grassland habitats, it is highly recommended that prescribed burns be used to maintain and enhance grassland habitats. This is especially important in the eastern portion of the park as native grassland habitat is highly fragmented and rapidly disappearing due to encroachment of woodland habitats.

### **Roads**

No direct impact of roads on mammal diversity within the park system is apparent. In fact, in the eastern portion of the park, roads constructed within the heavily wooded areas actually provide additional foraging areas for bats.

### **Invasive Species**

Smooth brome as an invader of native grassland habitats is a problem from the standpoint of a reduction of herbaceous diversity. This grass is invasive in all grassland habitats surveyed, and in areas where the habitat has been modified, such as the burned areas within Southshore, the return of native vegetation was accompanied by an increase in small mammal diversity.

## MOUNT RUSHMORE NATIONAL MEMORIAL

### **Abstract**

Mount Rushmore National Monument (MORU) was surveyed for small, terrestrial mammals during the summer of 2002. Wildlife cameras were deployed throughout the Memorial at different periods between August of 2002 and November of 2003. Bats were surveyed during the summer of 2004. Due to the nature of this Memorial, a paucity of information about the natural resources of the site existed before these surveys. Only one mammal, the mountain goat (*Oreamnos americanus*) was previously documented for MORU. The combined surveys reported herein added a minimum of 22 native species to the list of mammals documented for the site.

### **Methods-Terrestrial Species**

#### **Habitats/Locations Surveyed**

Ponderosa pine was considered the major habitat type at MORU. Specific locations are provided below.

#### **Survey Methods Used**

**Pitfall Stations.** Three pitfall stations, each consisting of five 4-gallon buckets and 20m of 10" fencing, were set in the park -- two in mesic areas close to drainages and one in a more upland ponderosa pine habitat. These pitfalls were run for 4 consecutive nights, providing a total of 60 trap nights for pitfalls.

**Live Traps.** Sherman transects were established in five areas of the park and run for a variable number of nights. Transect #1 (80 traps) began at the shooting/stress range, and proceeded north, then east, and finally south to loop around and over a low rise in primarily ponderosa pine habitat. Transect #2 (80 traps) started just east of the road leading to the well pen, and proceeded downstream (roughly to the east). Transect #3 (80 traps) began next to the spring in the drainage below the burn pit and proceeded upslope in a northwesterly direction. These three transects were run for 3 nights, producing 720 trap nights.

Two more trap lines with single trap stations (20 traps per line) were run for one night in the upper reaches of Starling Gulch. These lines were reached by hiking down the horse trail from the construction area south of the Visitor's center to the stream running through the bottom of the Gulch. One line (Starling Gulch Lower) started at the beaver pond and proceeded downstream. The second line (Starling Gulch Upper) started approximately 50m upstream of the beaver pond and proceeded upstream. These lines provided 40 more trap nights.

Finally, two 20-trap lines were run for one night in the area north of the main visitor area. North Lower Draw was set in a lush drainage area (no running water, but quite mesic) approximately 200m up a very light trail leading from one of the pullouts. North Upper Draw was set in a higher elevation dry drainage just below the “No trespass beyond this tree” signs below and behind the fenced area at the top of the monument. These lines provided an additional 40 trap nights.

Total Sherman live trap nights for the entire site was 800.

Pitfall stations were proximal to transects as follows:

<u>Pitfall Station</u>	<u>Sherman Transect</u>
PF-1 upland pine	#1
PF-2 mesic/riparian	#2
PF-3 mesic/riparian	#3

UTM Coordinates for pitfalls and live trap transects are provided below:

<b>Trapping</b>		<b>UTM COORDINATES</b>	
<b>Location</b>	<b>Zone</b>	<b>Easting</b>	<b>Northing</b>
PF1	13T	0625360	4860638
PF-2	13T	0624647	4860065
PF-3	13T	0624765	4859188
#1	13T	0625360	4860638
#2	13T	0624647	4860065
#3	13T	0624765	4859188

**Wildlife Cameras.** Motion-sensing wildlife cameras were deployed across 11 stations within MORU. Stations were baited with a variety of attractants including fish oil, mackerel, peanut butter, bacon grease, deer carcass, coon lure or fox lure (Appendix B). Cameras were generally set for a one-minute delay between images. The cameras were deployed for a total of 477 camera nights; however, known malfunctions reduced the the number of effective camera nights to 363.

## Dates

Pitfall stations were run for four consecutive nights, from 29 July through the night of 1 August 2002. Sherman live trap transects were run during the same period. Wildlife cameras were deployed at MORU during August through December of 2002, January of 2003, and October through November of 2003 (Appendix B).

**Observers**

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the trapping surveys with the assistance of Mr. Dan Licht in site selection and placement of pitfall stations. Mr. Dan Licht conducted the wildlife camera surveys.

**Methods-Bats****Habitats/Locations Surveyed**

Bat surveys were conducted over open pools of water at the bottom of Starling Gulch.

**Survey Methods Used**

**Mist Nets.** Mist nets were set over the beaver pond at the bottom of Starling Gulch.

**Acoustic Surveys.** Acoustic surveys were conducted at the beaver pond each night. Travel and search calls, as well as feeding buzzes, were recorded for subsequent analysis.

**Dates**

Mount Rushmore National Memorial was surveyed for bats the nights of 14-16 August 2004.

**Observers**

Surveyors were Dr. Cheryl A. Schmidt and Ms. Shauna R. Marquardt.

**Results-Terrestrial Species****Individuals Detected**

Table 9 provides details for species caught in pitfall stations, while Table 10 details captures in the live trap transects.

Table 9. Small mammals captured in pitfalls at MORU during summer 2002.

		Pitfalls (PF)			
Scientific Name	Common Name	PF-1	PF-2	PF-3	TOTAL
<i>Sorex cinereus/haydeni</i>	Masked or Hayden's shrew	1	1	3	5
<i>Reithrodontomys megalotis</i>	Western harvest mouse			1	1
<i>Clethrionomys gapperi</i>	Red-backed vole	2		2	4
<i>Microtus pennsylvanicus</i>	Meadow vole			2	2

Table 10. Small mammals captured in live trap transects at MORU in summer of 2002.

Scientific Name / Common Name	#1	#2	#3	Starling Gulch Lower	Starling Gulch Upper	North Low Draw	North High Draw	TOTAL
<i>Sorex cinereus/haydeni</i> / Masked or Hayden's shrew	2							2
<i>Tamias minimus</i> Least chipmunk	1		4				1	6
<i>Reithrodontomys megalotis</i> Western harvest mouse	2							2
<i>Peromyscus leucopus</i> White-footed deer mouse	4	16	15	2	4	2	2	45
<i>Peromyscus maniculatus</i> Deer mouse	6	58	15	1		1		81
<i>Clethrionomys gapperi</i> Red-backed vole		6	2			1		9
<i>Microtus pennsylvanicus</i> Meadow vole			1	3				4
<i>Zapus hudsonius</i> Meadow jumping mouse		1			1			2

A Habitat / Trap Type Summary is provided below. .

Mesic/Riparian Shermans<sup>1</sup>

*Tamias minimus* -- 4  
*Peromyscus leucopus*— 39  
*Peromyscus maniculatus*—75  
*Clethrionomys gapperi* – 9  
*Microtus pennsylvanicus* – 4  
*Zapus hudsonius* – 2

Upland Pine Shermans<sup>2</sup>

*Sorex cinereus/haydeni* – 2  
*Tamias minimus* – 2  
*Peromyscus leucopus*—6  
*Peromyscus maniculatus*—6  
*Reithrodontomys megalotis* -- 2

Mesic/Riparian Pitfalls

*Sorex cinereus / haydeni*—4  
*Reithrodontomys megalotis* - 1  
*Clethrionomys gapperi* – 2  
*Microtus pennsylvanicus* -- 2

Upland Pine Pitfalls

*Sorex cinereus/haydeni* – 1  
*Clethrionomys gapperi* -- 2

<sup>1</sup>Includes Transects #2 and #3, as well as Starling Gulch Upper and Lower, and North Low Draw.

<sup>2</sup>Includes Transect #1 and North High Draw



**Wildlife Cameras.** The 363 camera nights produced 58 identifiable images of mammals as follows:

White-tailed deer (*Odocoileus virginianus*) – 2  
Mule deer (*Odocoileus hemionus*) -- 40  
Unknown deer (*Odocoileus* sp.) – 3  
Bushy-tailed woodrat (*Neotoma cinerea*) -- 3  
Coyote (*Canis latrans*) –8  
Raccoon (*Procyon lotor*) – 2

**Other Observations.** White-tailed deer (*Odocoileus virginianus*) were observed north of the well pen. A very healthy and highly social striped skunk (*Mephitis mephitis*) joined the bat survey crew at the bottom of Starling Gulch during the summer of 2004. Two MORU staff reported seeing a weasel by the amphitheater on 8 November 2004. This was possibly either an ermine or a long-tailed weasel (*Mustela erminea* or *M. frenata*, respectively).

#### **List of Terrestrial Mammals Captured/Observed/Photographed at Mount Rushmore**

*Canis latrans* -- Coyote  
*Clethrionomys gapperi* – Red-backed vole  
*Mephitis mephitis* – Striped skunk  
*Microtus pennsylvanicus* – Meadow Vole  
*Neotoma cinerea* -- Bushy-tailed woodrat  
*Odocoileus hemionus* -- Mule deer  
*Odocoileus virginianus* – White-tailed Deer  
*Peromyscus leucopus* – White-footed Mouse  
*Peromyscus maniculatus* -- Deer Mouse  
*Procyon lotor* -- Raccoon  
*Reithrodontomys megalotis* -- Western Harvest Mouse  
*Sorex cinereus* / *haydeni* – Masked or Hayden's shrew  
*Tamias minimus* – Least Chipmunk  
*Zapus hudsonius* – Meadow Jumping Mouse

## **Results-Bats**

### **Individuals detected**

Table 11 provides details for the bats captured at MORU.

Table 11. Bat species captured in mist nets over the beaver pond at the bottom of Starling Gulch in MORU, August 2004.

<u>Species</u>	<u>Common Name</u>	<u>Number Caught</u>	<u>Gender; Age class, reproductive condition</u>
<i>Eptesicus fuscus</i>	Big brown bat	6	1 Female; juvenile 5 Males; adult, scrotal
<i>Lasionycteris noctivagans</i>	Silver-haired bat	4	1 Female; juvenile 1 Female; adult, lactating 2 Males; adult, non-scrotal
<i>Myotis ciliolabrum</i>	Small-footed bat	2	2 Males; adult, non-scrotal
<i>Myotis lucifigus</i>	Little brown bat	13	7 Males; adult, scrotal 6 Males; adult, non-scrotal
<i>Myotis septentrionalis</i>	Northern long-eared myotis	6	1 Female; juvenile 4 Females; adult, lactating 1 Male; juvenile
<i>Myotis volans</i>	Long-legged myotis	1	1 Male; adult, scrotal

**TOTAL = 32 bats**

**Acoustic Surveys.** Acoustic recordings were screened and clean, single-species calls were selected for identification. A discriminant function model was developed based on known-species calls and then used to assign the selected calls to species. Using this process, seven bat species were identified at MORU based on their echolocation calls (list below). Only two of the species identified in this manner were not also caught in mist nets (\* below). The seven species identified base on echolocation analyses were:

- Big brown bat (*Eptesicus fuscus*)
- Silver-haired bat (*Lasionycteris noctivagans*)
- \*Western long-eared bat (*Myotis evotis*)
- Western small-footed bat (*M. ciliolabrum*)
- Little brown myotis (*M. lucifugus*)
- \*Northern long-eared myotis (*M. septentrionalis*)
- Fringed myotis (*M. thysanodes*)

### ***Species Not Documented but Possibly Present***

Most of the species currently listed as “expected” but thus far undocumented for the Memorial may be present in or adjacent to MORU.

### ***Species on Park Expected List but Probably Not Present***

All species on the expected list, with the probable exception of the Northern grasshopper mouse (*Onychomys leucogaster*) could be reasonably assumed to have the potential to occur at MORU.

### ***Recommendations to Park Management***

Long-term monitoring of the mammal species at MORU is recommended. While snapshot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more complete understanding of the mammalian community utilizing MORU. In particular, trapping regimes targeting mustelids and other small- to medium-sized carnivores may add species to the list documented for the Memorial. Placement of such traps in boulder fields and along drainages is recommended.

### ***Species of Concern***

Of the species documented in these surveys, the bats are the primary species of concern. Bats, because of their specific habitat requirements and the sensitivity of at least some of the species to anthropogenic disturbance, are often considered indicator species. MORU supports an apparently abundant and diverse bat community. As such, critical resources for these bats, such a roosting sites and drinking/foraging ponds, should be carefully managed to maintain their availability to bats.

## **Habitat Enhancement or Other Conservation Recommendations**

The water resources, specifically the open pools, in the bottom of Starling Gulch are critical resources for bats. Bats utilize these pools for watering and for foraging. Protection of the quantity and quality of water in these pools and the herbaceous vegetation around them is important to ensure continued availability of drinkable water and a sufficient prey base for bats.

From a purely wildlife conservation/habitat ‘enhancement’ standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of MORU should be avoided if possible.

## **Potential Impacts to Species**

### **Visitors**

Potential impacts of visitors on native species include vehicular strikes on roads, spread of non-native/invasive plant propagules, and wildfire. In addition, at MORU specifically, helicopter tours over the Memorial may present the potential for impacts to native species. The species currently occupying the Memorial do not appear to be impacted by these tours. Nighttime helicopter tours during the critical bat maternity and lactation periods, primarily early June through mid-August, should be avoided. While the current surveys indicated substantial populations of bats at the Memorial, foraging habitats and patterns throughout the site are unknown. Research to elucidate nocturnal activity patterns (both temporal and spatial) may need to be conducted to understand and ameliorate potential impacts of nighttime visitation of any nature.

### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from early June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable. If hibernacula are identified at MORU, prescribed fires should be conducted to avoid smoke from the fires blowing toward the hibernacula.

### **Roads**

None of the mammalian species documented at MORU in these surveys are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

### **Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.

## SCOTTS BLUFF NATIONAL MONUMENT

### ***Abstract***

Scotts Bluff National Monument (SCBL) was surveyed for small, terrestrial mammals during the early fall of 2002. Wildlife cameras were deployed at the Monument during the late fall of 2002 and early spring of 2003. Bat surveys were conducted during the summers of 2003 and 2004. The combined surveys documented the presence of 45% of the species previously documented for the Monument. These surveys added five native species, primarily bats, to the list of those documented for SCBL.

### ***Methods-Terrestrial Species***

#### **Habitats/Locations Surveyed**

Primary habitat types surveyed for terrestrial mammals at SCBL were badlands topography, riparian forest, and grassland. Specific locations are provided in the next section.

#### **Survey Methods Used**

**Pitfall Stations.** Three pitfall stations were set in riparian forest and grassland habitats as described in the inventory protocol, for a total of 6 pitfall stations. Each pitfall station consisted of five 4-gallon buckets and 20m of 10" fencing. These stations were run in each habitat for 4 consecutive nights, providing a total of 60 trap nights per habitat for pitfalls. Pitfall stations were associated with Sherman transects (described below), or located independently, as follows:

#### **Pitfall Station**

PF-1 (grassland)

PF-2 (grassland)

PF-3 (riparian forest)

PF-4 (riparian forest)

PF-5 (riparian forest)

PF-6 (grassland)

#### **Sherman Transect**

GRA-1 (south of prairie dog town)

BL-1 (grassy area on slope of badlands topography; inside 1<sup>st</sup> bow on Gering Canal Rd., east of Dobie Brick Rd)

RIP-3 (outside of SE corner of 1<sup>st</sup> bow in Gering Canal Rd that is E of Dobie Brick Rd)

RIP-1 (transect started north of railroad tracks across from Dobie Brick Rd and proceeds ESE)

RIP-2 (transect started about 100m west of culvert passage beneath railroad tracks at end of Dobie Brick Rd and proceeds NNW)

GRA-3 (across highway and southeast of Visitor's Center, on top of slope)

**Live Traps.** Sherman live trap transects were established in each of the primary habitats (badlands topography, riparian forest, and grassland) to provide a minimum of 500 trap nights per habitat (details below).

Nine Sherman transects, three in each major habitat type (RIP=riparian forest, GRA=grassland, BL=badlands topography) were established as follows:

- RIP-1 (80 traps) started at Pitfall Station #4, north of tracks across from Dobie Brick Rd and proceeded ESE (106°) in riparian woods between canal and railroad tracks.
- RIP-2 (80 traps) started at Pitfall Station #5, about 100m west of culvert passage beneath railroad tracks at end of Dobie Brick Rd and proceeds NNW (along base of railroad track bluff”).
- RIP-3 (40 traps) started at Pitfall Station #3, outside of SE corner of 1<sup>st</sup> bow in Gering Canal Rd that is E of Dobie Brick Rd, and proceeded SSE (145°) from pitfall.
- GRA-1 (80 traps) started at Pitfall Station #1, south of prairie dog town off of Gering Canal Rd., and proceeded due south (180°).
- GRA-2 (40 traps) along old 2-tracker past dump and going to old Boy Scout picnic grounds, W of Hwy 92 close to west edge of park.
- GRA-3 (80 traps) started at Pitfall Station #6, across highway from and slightly SE of the Visitor’s Center, and proceeded SE at 140°.
- BL-1 (80 traps) started at dead juniper about 50m up the rise from Pitfall Station #2, proceeded down into badlands proper, north across small stream, and through willows along same stream.
- BL-2 (40 traps) inside West edge of 1<sup>st</sup> bow in Gering Canal Rd, east of Dobie Brick Rd. Smack dab in middle of a rattlesnake’s home range (we saw him/her every day).
- BL-3 (80 traps) In Pine/Juniper badlands area at base of South Bluff near old Boy Scout Picnic ground, west of Hwy 92 close to west edge of park.

Total Sherman live trap nights for the monument was 2280.

UTM Coordinates for pitfall stations and live trap transects are provided below:

#### COORDINATES

<u>Trapping Location</u>	<u>UTM Zone</u>	<u>Easting</u>	<u>Northing</u>
PF-1	13 T	0606609	4633767
PF-2	13 T	0608236	4633615
PF-3	13 T	0608216	4633290
PF-4	13 T	0607989	4634313
PF-5	13 T	0607824	4634287
PF-6	13 T	0607662	4631172
BL - 1	13 T	0608236	4633615
BL - 2	13 T	0608117	4633316
BL - 3	13 T	0606451	4631094
GRA - 1	13 T	0606609	4633767
GRA - 2	13 T	0606332	4631875
GRA - 3	13 T	0607662	4631172
RIP - 1	13 T	0607989	4634313
RIP - 2	13 T	0607824	4634287
RIP - 3	13 T	0608216	4633290

**Box Traps.** During the summer of 2003, six medium-sized, wire box traps (Tomahawk-style) were set in the Gering Canal (dry at the time), and in the badlands topography north of the canal and toward the east edge of the Monument, and baited with sardines. These traps will not be discussed further as they captured only magpies.

**Wildlife Cameras.** Motion-sensing wildlife cameras were deployed across 10 stations within SCBL. Stations that were baited (some were not) were baited with either fish oil, coon lure or fox lure (Appendix B). Cameras were generally set for a one-minute delay between images. The cameras were deployed for a total of 350 camera nights; however, known malfunctions reduced the the number of effective camera nights to 280.

#### Dates

Pitfall stations and live trap transects were run from 11-15 September, 2002.

Wildlife Cameras were deployed at the Monument from 9 October to 4 November of 2002, and again from 20 March to 24 April of 2003.

#### Observers

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the trapping surveys. Mr. Dan Licht conducted the wildlife camera surveys.



## ***Methods-Bats***

### **Habitats/Locations Surveyed**

A variety of habitats were surveyed, either acoustically or with mist nets, in an attempt to document the bat species at SCBL. The areas netted included the floodplain forest along Central Canal on the north edge of the Monument, and ephemeral pools on the Saddle Rock Trail. Acoustic surveys were conducted along Gering Canal Road, along the Saddle Rock Trail, at the Visitor Center, in the floodplains forest, and at the ends of the tunnel running underneath the railroad track.

### **Survey Methods Used**

**Mist Nets.** In 2003, the bat survey work in general was hampered by weather and the water stage in the Gering Canal. Upon arrival of the bat crew to the site, the canal was running strong, with no quiet, isolated pools over which to net. Mist nets, in order to be effective at capturing bats, need to be set over isolated, calm sources of water. Setting nets along a full-running body of water such as the canal or a river, is generally not very productive. The water level issue was compounded by stormy weather with strong winds being a nightly factor. As such, mist nets were set only over isolated, ephemeral pools of water along the lower portion of Saddle Rock Trail. No bats were captured in mist nets. In 2004, nets were set in the floodplain forest by Central Canal and over the openings to the culvert running underneath the railroad tracks.

**Acoustic Surveys.** In 2003, bat detectors were used to monitor areas around the Visitor's center, Saddle Rock Trail (high and low), and Gering Canal. In 2004, acoustic surveys were conducted in the floodplain forest along Central Canal and within the culvert running underneath the railroad tracks.

### **Dates**

Bats were surveyed 9-13 June of 2003 and 2-5 August of 2004.

### **Observers**

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the bat surveys.

## ***Results-Terrestrial Species***

### **Individuals Detected**

Table 12 identifies species caught in the pitfall stations, while table 13 details those caught in the live trap transects.

Table 12. Small mammals caught in pitfalls at SCBL during September of 2002.

Scientific Name / Common Name	Grassland (GRA)			Riparian (RIP)			
	PF1	PF2	PF6	PF3	PF4	PF5	TOTAL
<i>Sorex haydeni/cinereus</i> Masked or Hayden's shrew	1				1	1	3
<i>Microtus spp.</i> Vole					1*		1
*Caught in riparian pitfall; too wet to identify species.							

Table 13. Small mammals caught in live trap transects at SCBL during September 2002.

Scientific Name / Common Name	Badlands			Grassland			Riparian			TOTAL
	BL 1	BL 2	BL 3	GRA 1	GRA 2	GRA 3	RIP 1	RIP 2	RIP 3	
<i>Sorex haydeni/cinereus</i> Masked or Hayden's shrew	1									1
<i>Reithrodontomys megalotis</i> Western harvest mouse						1	2	1		4
<i>Peromyscus maniculatus</i> Deer mouse	5	10	18	3	1	8	3	1	20	69
<i>Microtus ochrogaster</i> Prairie vole	3	2	2	2			1	4		14
<i>Microtus pennsylvanicus</i> Meadow vole	6						3			9
<i>Mus musculus</i> House mouse		1								1

A Habitat / Trap Type Summary is provided below. Table 1 (a separate Excel attachment) provides detailed information about species and capture locations.

#### Riparian Forest Shermans

*Microtus ochrogaster* – 5

*Microtus pennsylvanicus* -- 3

*Peromyscus maniculatus*—24

*Reithrodontomys megalotis* -- 3

#### Grassland Shermans

*Peromyscus maniculatus*—12

*Reithrodontomys megalotis* -- 1

*Microtus ochrogaster*—2

Badlands Topography Shermans

*Sorex cinereus/haydeni* – 1  
*Peromyscus maniculatus*—33  
*Microtus ochrogaster*—7  
*Microtus pennsylvanicus*—6  
*Mus musculus* -- 1

Riparian Forest Pitfalls

*Sorex cinereus / haydeni*—2  
*Microtus spp.* – 1

Grassland Pitfalls

*Sorex cinereus / haydeni*—1

**Wildlife Cameras.** The 280 effective camera nights at SCBL produced 106 identifiable images of mammals as follows:

White-tailed deer (*Odocoileus virginianus*) – 21  
Mule deer (*Odocoileus hemionus*) -- 33  
Unknown deer (*Odocoileus* sp.) – 10  
Beaver (*Castor canadensis*) -- 7  
Coyote (*Canis latrans*) – 6  
Raccoon (*Procyon lotor*) – 24  
Cottontail rabbit (*Sylvilagus* sp.) -- 5

**Other Observations.** Of course, prairie dogs (*Cynomys ludovicianus*) were observed in the prairie dog town off of Gering Canal Road. A large mule deer (*Odocoileus hemionus*) buck was observed several mornings in the buckbrush north of the railroad tracks as we came through the culvert underpass. Cottontail rabbits (*Sylvilagus* spp) were observed around the Visitor's Center and heard in brushy areas along the Gering Canal Road. A coyote (*Canis latrans*) was observed south of the prairie dog town. Three pronghorn (*Antilocapra americana*) were observed late on the evening of 11 September, right at dusk, just beyond the last draw SE of the visitors center before the large flat area between South Bluff and Dome Rock. Prairie rattlesnakes (*Crotalus viridis viridis*) were observed/photographed in riparian and badland areas south of the Gering Canal Road. A young bullsnake (*Pituophis melanoleucus sayi*) was observed/photographed in the prairie dog town.

**Alphabetical List of Mammals Captured/Observed/Photographed at SCBL**

*Antilocapra americana* -- Pronghorn  
*Canis latrans* -- Coyote  
*Castor canadensis* -- Beaver  
*Cynomys ludovicianus* -- Black-tailed Prairie Dog  
*Microtus ochrogaster* -- Prairie Vole  
*Microtus pennsylvanicus* -- Meadow Vole  
*Mus musculus* -- Domestic mouse  
*Odocoileus hemionus* -- Mule Deer  
*Odocoileus virginianus* -- White-tailed deer  
*Peromyscus maniculatus* -- Deer Mouse  
*Procyon lotor* -- Raccoon  
*Reithrodontomys megalotis* -- Western Harvest Mouse  
*Sorex cinereus* / *haydeni* -- Masked or Hayden's shrew  
*Sylvilagus* spp-- Cottontail Rabbits

**Results-Bats****Individuals detected**

**Mist Nets.** No bats were captured in mist nets in 2003 or in the nets set in the floodplain forest on the first net night of 2004. On the second night (8/03/2004), the mist nets set over the opening to the railroad track culvert produced 5 Western small-footed myotis (*Myotis ciliolabrum*) as follows:

2 Lactating females  
1 Non-lactating female  
2 Non-scrotal males

The culvert was carefully examined prior to dusk on both the first and second nights of the survey. No bats were observed during the pre-dusk period, indicating that the bats are not using this structure as a day roost. These bats are apparently roosting elsewhere during the day, emerging to forage, and then using the culvert as a temporary night roost after the first foraging bout.

**Acoustic Surveys.** Acoustic recordings were screened and clean, single-species calls were selected for identification. A discriminant function model was developed based on known-species calls and then used to assign the selected calls to species. Using this process, six bat species were identified at SCBL based on their echolocation calls (list below) recorded during the two summers. The six species identified base on echolocation analyses were recorded as follows:

Species Name	Common Name	2003	2004
<i>Eptesicus fuscus</i>	Big brown bat	X	X
<i>Lasionycteris noctivagans</i>	Silver-haired bat		X
<i>Myotis ciliolabrum</i>	Western small-footed myotis	X	
<i>M. lucifugus</i>	Little brown myotis	X	X
<i>M. septentrionalis</i>	Northern long-eared myotis	X	
<i>M. thysanodes</i>	Fringed myotis		X

### **Species Not Documented but Possibly Present**

*Zapus hudsonius* (Meadow jumping mouse) may disperse into the Monument along the Central Canal.

### **Species on Park Expected List but Probably Not Present**

Scotts Bluff NM appears to have one of the more well-documented mammalian communities of the parks within the network. Species remaining on the expected list are reasonable to expect to find in or near the Monument.

### **Recommendations to Park Management**

#### **Long-term Monitoring Recommendations**

Long-term monitoring of the mammal species at SCBL is recommended. While snapshot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more complete understanding of the mammalian community utilizing the Monument (as evidenced by Cox and Franklin (1989)). Trapping regimes targeting mustelids and other small- to medium-sized carnivores, as well as ongoing bat surveys, may add species to the list documented for SCBL.

#### **Species of Concern**

Of the species documented in these surveys, the bats are the primary species of concern. Bats, because of their specific habitat requirements and the sensitivity of at least some of the species to anthropogenic disturbance, are often considered indicator species. While the relative abundance of bats may not be as high at SCBL as at a few of the other parks within the network, these populations and the habitat that supports them are no less important. Riparian habitats represent linear strips of relatively optimal habitat for bats in the northern great plains and should be managed for bats, as well as for the host of other species that rely heavily on these corridors in this region.

#### **Habitat Enhancement or Other Conservation Recommendations**

Control, or preferably eradication, of non-native species – both plant and animal – within the boundary of SCBL is recommended. Presence of domestic/feral cats and dogs (if

they occur; not documented in these surveys) should be aggressively addressed, as should the presence of exotic mice such as *Mus musculus*.

From a purely wildlife conservation/habitat ‘enhancement’ standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of the Monument should be avoided if possible.

## **Potential Impacts to Species**

### **Visitors**

Potential impacts of visitors on native species include vehicular strikes on roads, spread of non-native/invasive plant propagules, and wildfire. Although a relatively heavily-used highway passes through the approximate middle of the Monument, the impacts of this road on wildlife populations is probably not measurable.

### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from mid-June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable.

### **Roads**

None of the mammalian species thus far documented at SCBL are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

### **Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.

## WIND CAVE NATIONAL PARK

### ***Abstract***

Wind Cave National Park (WICA) was selected for a bat survey only (no terrestrial mammal trapping or wildlife camera surveys). The survey for bats was conducted in August of 2004, utilizing mist nets and Anabat acoustic monitoring systems. Nine species of bats were captured in the mist nets and a tenth species was identified based on statistical analysis of echolocation calls. This survey, when combined with previously documented records of Townsend's big-eared bats in the Park, completes documentation of the presence of all bat species on the Park's expected list.

### ***Methods-Bats***

#### **Habitats/Locations Surveyed**

Water sources, either quiet pools in flowing streams such as Beaver Creek and Reeve's Gulch, or isolated ponds such as Herp Pond, were surveyed for use by bats. Specific locations and the dates on which they were netted follow.

**Site: Beaver Creek-1**

UTM: 13T 0622487 4826744

Date Worked: 9 August 2004

**Site: Reeve's Gulch**

UTM: 13T 0622258 4828338

Date Worked: 12 August 2004

**Site: Beaver Creek-2**

UTM: 13T 0622843 4826415

Date Worked: 10 August 2004

**Site: Herp Pond**

UTM: 13T 0620678 4820261

Date Worked: 13 August 2004

**Site: Beaver Creek-3**

GPS Coordinates: 13T 0623519 4826748

Date Worked: 11 August 2004

#### **Survey Methods Used**

**Mist Nets.** Mist nets were run at each of the above locations.

**Acoustic Surveys.** Anabat detectors were used to record bat activity at each of the above sites.

## Dates

Mist net and acoustic surveys were conducted the nights of 9-13 August 2004.

## Observers

Dr. Cheryl Schmidt and Ms. Shauna Marquardt conducted the surveys with the welcome assistance and guidance of Mr. Dan Foster on the nights of 11-13 August.

## Results-Bats

### Individuals detected

**Mist Nets.** Nine species of bats were captured in mist nets during the five nights of surveys

<i>Eptesicus fuscus</i>	Big brown bat
<i>Lasionycteris noctivagans</i>	Silver-haired bat
<i>Lasiurus borealis</i>	Eastern red bat
<i>Lasiurus cinereus</i>	Hoary Bat
<i>Myotis ciliolabrum</i>	Small-footed bat
<i>Myotis lucifugus</i>	Little brown myotis
<i>Myotis septentrionalis</i>	Northern long-eared myotis
<i>Myotis thysanodes</i>	Fringe-tailed bat
<i>Myotis volans</i>	Long-legged myotis

Many of these species were represented by both juvenile and adult individuals. For further details, please reference the Wind Cave NP Post-Visit Report in Appendix C. The capture of an Eastern red bat (*Lasiurus borealis*) represents the first capture of this species in the Park.

**Acoustic Surveys.** Acoustic recordings were screened and clean, single-species calls were selected for identification. A discriminant function model was developed based on known-species calls and then used to assign the selected calls to species. Using this process, ten bat species were identified at WICA based on their echolocation calls (list below). Only one of the species identified in this manner (*Myotis evotis*, the Western long-eared bat) was not also caught in mist nets (\* below). The ten species identified base on echolocation analyses were:

Big brown bat (*Eptesicus fuscus*)  
Silver-haired bat (*Lasionycteris noctivagans*)  
Eastern red bat (*Lasiurus borealis*)  
Hoary bat (*Lasiurus cinereus*)



- \*Western long-eared bat (*Myotis evotis*)
- Western small-footed bat (*M. ciliolabrum*)
- Little brown myotis (*M. lucifugus*)
- Northern long-eared myotis (*M. septentrionalis*)
- Fringed myotis (*M. thysanodes*)
- Long-legged myotis (*M. volans*)

**Other Observations.** Mr. Dan Foster reported the capture of a Townsend's big-eared bat (*Corynorhinus townsendii*) at a cave in the northeastern section of the Park during late August.

### ***Bat Species Not Documented but Possibly Present***

The eastern pipistrelle (*Pipistrellus subflavus*) has been recently reported to occur in the Black Hills area (J. Tigner, pers. comm. 2004), and may also occur in or at least pass through WICA. The spotted bat (*Euderma maculatum*), although somewhat unlikely, is still a 'possible' inhabitant of the Park.

### ***Bat Species on Park Expected List but Probably Not Present***

All bat species on WICA's expected list have now been documented at the Park.

## ***Recommendations to Park Management***

### **Long-term Monitoring Recommendations**

Long-term monitoring of the bats at WICA is recommended. While snap-shot surveys can provide important information, sustained monitoring for longer periods of time, through all seasons of the year, and over many years, will provide a much more complete understanding of the bat community utilizing the Park.

Monitoring of bat habitat utilization before and after management actions such as prescribed fire is highly recommended.

### **Species of Concern**

All of the bat species occurring at WICA are species of concern. Bats, because of their specific habitat requirements and the sensitivity of at least some of the species to anthropogenic disturbance, are often considered indicator species. WICA currently supports reproductive populations of a very diverse bat community. All management actions should consider the potential for impacts to these species.

### **Habitat Enhancement or Other Conservation Recommendations**

Control, or preferably eradication, of non-native species – both plant and animal – within the boundary of WICA is recommended. Presence of domestic/feral cats and dogs (if

they occur; not documented in these surveys) should be aggressively addressed. Populations of native species, such as deer and elk, should be maintained at levels that the habitat within the park can sustain without degradation.

WICA should be commended for initiating a prescribed burn program and for supporting research to establish baseline conditions before the burns and monitor community responses after the burns. While fire is undoubtedly a natural component of this system, as mentioned under Prescribed Fire below, understanding of the complex interactions among the various plant and animal communities and fire is disturbingly lacking.

From a purely wildlife conservation/habitat ‘enhancement’ standpoint, further incursions (i.e. groomed trails, roads, etc.) into currently undeveloped portions of the Monument should be avoided if possible.

## **Potential Impacts to Species**

### **Visitors**

Potential impacts of visitors on native species include vehicular strikes on roads, spread of non-native/invasive plant propagules, and wildfire. Although a relatively heavily-used highway passes through the approximate middle of the Park, the impact of this road on wildlife populations is probably not measurable.

### **Prescribed Fire**

Fire was a natural component of the Northern Great Plains ecosystem and the mammals living in the region today evolved with fire as a periodic disturbance. However, changes in vegetation brought about by fire suppression and altered land uses over the past century may impact fire dynamics and, therefore, species responses. Until sufficient data are available to accurately predict species-level responses to prescribed burns, it is recommended that prescribed burns be applied to small areas on a rotational basis. Pre- and post-burn surveys should be conducted to better understand the interaction between prescribed burns and mammalian use of the habitat. Given the bat species occupying the area during the summer months, burns should not be planned for the maternity and lactation period which occurs primarily from mid-June to mid-August. To avoid potential impacts to bats, late fall burns would be preferable. Burns should be conducted to avoid smoke reaching known roosts or hibernacula.

### **Roads**

None of the mammalian species thus far documented at WICA are known to be limited in dispersal by roads. As mentioned above under Visitor Impacts, vehicular strikes are an issue for all species, but probably do not limit populations.

### **Invasive Species**

Invasive species have been documented to alter utilization of infested habitats by native mammals, particularly ungulates (Trammel and Butler 1995). While responses of small mammal species such as most rodents and bats to establishment of invasive plant

monocultures are not as well-studied, it is reasonable to predict that there is some impact on these species.

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**Appendix A**

**Comprehensive Spreadsheet of Documented and Expected Mammals  
In The  
National Park Service  
Northern Great Plains Network  
(Parks surveyed for mammals in 2002-2004)**

December 2004

National Park Service  
Northern Great Plains Region  
Mammal Inventory Report

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**Appendix B**

**Documentation of Wildlife Species  
in  
Northern Great Plains National Parks  
Using Automated Cameras**

**Final Report  
by  
Daniel S. Licht  
Northern Great Plains Inventory & Monitoring Coordinator**

**Appendix C**

**Post-Visit Reports for Mammal Surveys  
2002-2004**

**(does not include MNRR)**